## THE INSTITUTION OF NAVAL ARCHITECTS.

The annual meeting of the Institution of Naval Architects for 1881 began on Wednesday, the 6th inst., in the Hall of the Society of Arts, John-street, Adelphi, and terminates this evening. The morning meetings begin each day at noon, and the evening meetings held on the 7th and 8th at 7 p.m. The president, the Earl of Ravensworth, filled the chair. The proceedings commenced on Wednesday with the transaction of the general business of the Institution, such as the election of the Council and of new members. The annual report of the Council was then read. The Council deeply regretted having to announce the death of Lord Hampton, the late President of the Institution. Lord Hampton, who only resigned at the close of the last annual meeting, had been president of the Institution ever since its foundation in the year 1860. His lordship's services are fresh in the memory of every member and associate, and the best testimony to them is the flourishing condition in which he left the Institution. The Council was glad to be able to report that the funds of the Institution continue to be in a satisfactory condition. Acting upon a generally expressed wish the Council has, during the past year, caused the preparation of a General Index of the twenty-one published volumes of Transactions. This index is now completed, and will be shortly on sale at the price of ten shillings to the general public, and only five shillings to members and associates of the Institution. At the invitation of the Lord Provost of Glasgow and of the committee of the Naval and Marine Engineering Exhibition, a deputation from the Council proceeded to Glasgow in November last, in order to represent the Institution at the opening of the Naval Exhibition. The deputation is of opinion that exhibitions similar to that now being held in Glasgow are, when systematically organised, of great interest and utility, and might with advantage be held at fixed intervals of time.

After some further business of a general character had been transacted, the president proceeded to address the meeting. He said that at no time before did so many questions of importance present themselves for consideration in connection with the Institution, and he now proceeded to dwell at some length on the present commercial position of Great Britain in general, and of her shipping interests in particular. He found the Clyde held her honoured position at the head of the list, having built last year one-half more tonnage than she did in 1879, and 1879 was a very fairly active shipbuilding year all over the kingdom. The Wear built one-third more than in 1879; the Tees more than 50 per cent. increase over 1879; the Tyne only built one-tenth more, and she actually built twenty-one vessels fewer, but she built upwards of 10,000 tons more shipping than in 1879. Now that was important, because it showed that the efforts of our shipbuilders were directed to larger and more powerful, and consequently swifter vessels. The figures were as follows: The Clyde built, in 1879, 191 vessels, with 168,460 tons; in 1880 she built 209 vessels and 236,579 tons. The Tyne built, in 1879, 130 vessels and 139,843 tons; in 1880 she built 109 vessels only, but with 149,082 tons. The Wear built sixty-five vessels in 1879, and 92,176 tons; and in 1880 seventy-seven vessels, with 116,227 tons. The Tees built twenty-five vessels, with a tonnage of 31,756; and in 1880, thirty-eight vessels, with 48,506 tons; and the value of the vessels in the north-eastern ports, built last year, amounted to seven millions of money. In February last there were building in the various shipbuilding establishments in this country no less than 650,000 tons of shipping under Lloyd's rules, and in addition to that there were 150,000 tons more not under Lloyd's qualification, making a total of not less than 800,000 tons of shipping in course of construction in February last. Our steam fleet had increased since 1850 from 1350 vessels to 6690 vessels, representing 2,730,000 tons of shipping, or one million more tons than of all other steam ships of the world put together. He was therefore justified in saying that we held a very fair position in the carrying trade. He knew that some high authorities thought that steel was the material for the future, both for our merchant and for our war vessels; but, at the same time, they must remember that price has a great deal to do with material, and the present price of steel would probably for some time to come be a serious impediment to its employment for the ordinary ship and rougher description of merchant vessels. But there were eminent authorities, and he was rather disposed to be with them, who considered that the days of iron for shipbuilding purposes were numbered. He wished to quote a fact from the chairman of the Cunard Company to show the advance in Cunard ocean steamers. He said that when the Britannia made her first voyage forty years ago she measured 1139 tons, cargo capacity 225 tons, and she steamed 8¼ knots. Referring to the French bounty system he said that the French bounty upon the first cost of a vessel had been variously estimated to be very nearly one-fifth of the cost. Supposing a vessel to cost £50,000, the bounty would amount to something very near £12,000. But there was another branch of it. There was a bounty upon the navigation of the vessel amounting to 1½f. per registered ton per 1000 miles run on any direct line. Now that had been calculated to amount in one year to 17½ per cent. upon the first cost of the vessel, and he would put the navigation bounty at 12½ per cent. more upon the navigation, which amounted to no less a sum than 30 per cent. of the capital invested in that ship in one year. The effect of that appeared to him to be to put absolutely at least half that amount into the pocket of the shipowner in the shape of profit. We must look to greater care in the conduct of experiments upon designs in our shipbuilding establishments in order to bring ingenuity and theory to the test of practice. These were the objects and purposes of this Institution, and it is in the fulfilment of this great purpose that they would gain for themselves that to which he thought they were fairly entitled—the title, namely, of one of the most useful and practical institutions in the country.

The first paper read was by Mr. J. D'A. Samuda,

### On the Almirante Brown Argentine, cased Corvette, and the Effect of Steel Hulls and Steel-faced Armour on Future War-ships.

The author said that the Almirante Brown was he believed the first vessel afloat which had been constructed entirely of steel and coated with steel-faced armour, and he believed that a reference to her guns carried, the armour-resisting power obtained, and the great capability of steaming without recoaling, would show advantages beyond those possessed by any previous vessel of similar tonnage and power, results mainly due to the material employed in the construction of hull and armour. This is a vessel of moderate size combining all the latest improvements in construction, armour, and armament. The hull is built entirely of Siemens steel; the armour is "compound" or steel-faced, consisting of an armour belt extending 120ft. in length, and protecting the engines, boilers, and magazines, with cross armoured bulkheads at ends of belt reaching from 4ft. below the water-line to the main deck. Above the main deck amidships is an armour-plated battery with double embrasures at the fore end, and containing in all six guns. The armour-plates are worked on a teak backing, and are screwed to the skin with bolts and nuts from the inside, so arranged as not to wound the steel face of the armour. Horizontal armour of steel plates is worked from the battery to the ends of the vessel, forming a shell-proof and water-tight deck 4ft. below the water, protecting the steering apparatus, &c. The bottom is covered with teak planking 3in. thick, and zinc sheathing from keel to 3ft. above the water, as a protection against fouling. This vessel is fitted with a double bottom, and divided by transverse bulkheads and steel decks into forty-eight watertight compartments. The plating of the hull varies from $\frac{5}{8}$in. to $\frac{7}{16}$in. except behind the armour, where it is 1in. thick. She has two pole masts, and an area of sail of 10,000 square feet. The armament consists of six Armstrong's improved type 8in. 11½-ton long breech-loading guns fitted in battery, and so arranged as to give an all-round fire; one similar gun on upper deck forward and one aft; also six 4½in. broadside guns on upper deck. Her machinery consist of two sets of inverted compound surface condensing engines of the collective indicated power of 4500 horses—each set working its own screw, and being fitted in its own separate engine-room. The boilers are eight in number, cylindrical; the boiler room being divided into four separate watertight compartments. The steel-faced armour used, 9in. thick, has been found in practice to be equal in shot resistance to iron armour of 12in. thick, and to resist a shot from a 12-ton muzzle-loading gun at 10 yards; while the guns used in this vessel, though weighing each only 11½ tons, are able to penetrate 13·3in. of ordinary armour at 70 yards, and this is equal to the penetrating power of the service muzzle-loaders of 18 tons in weight. Five of the guns can be brought to act almost in a direct line ahead, while an all-round fire is obtainable in which nearly every gun can participate. The speed is expected to reach 13¾ knots, and the coal carried is sufficient to enable the vessel to steam at a low rate of speed—say 8 knots—6000 miles, or at a speed of 10 knots to cover 4300 miles of distance. The effect of substituting steel for iron in the hull, and steel-faced armour for iron armour, has been to obtain the same strength and resistance to shot that could have only been obtained in an iron vessel of similar size and strength with 510 tons additional material, and when increased in dimensions to meet this—as given below—a further 350 tons would be needed for the extra weight due to the enlarged hull. An iron-built and armoured vessel constructed to carry this additional weight, and of such extra dimensions as would be necessary if the same speed were to be maintained, draught of water preserved, and coal-carrying capacity maintained, would have to be increased in size, displacement, and power as follows. The iron ship would have to be constructed:—Length, 260ft.; breadth, 55ft.; displacement, 5200 tons; coal to be carried, 720 tons; power, 5000 horses while the steel vessel with steel-faced armour, as already described, would be:—Length, 240ft.; breadth, 50ft.; displacement, 4200 tons; coal to be carried, 650 tons; power, 4500 horses. It would involve 1000 tons additional displacement, and 500 additional horse-power, to get in the iron ship equal speed and shot-resisting power and she must carry 70 tons additional coal to enable her to travel an equal mileage without re-coaling.

The discussion which followed was opened by Sir John Hay, who said that, according to Captain Columb, this country requires sixty-two ironclads, and we have forty-one; a considerable number of small ironclads would prove very useful, and Mr. Samuda's designs seemed to be very good. The Almirante Brown was not all armoured, but it must be borne in mind that at first no one thought of making an invulnerable ship—something just to keep out shells was all that was asked for. A great deal was to be gained by giving up part of a ship's armour, and the gain had been judiciously realised by Mr. Samuda. As for the gun in the bows intended to fire right ahead, he did not think that would be used with the other guns amidships firing also ahead, as their shot must go close past the gunners working the bow gun. As to the speed, he did not think 13½ knots enough. A great point in favour of a small ironclad was that if her draught were less than 24ft. she could go through the Suez Canal—an enormous advantage.

Admiral Sir Spencer Robinson had always advocated the use of steel in shipbuilding, and he congratulated the Institution on the success which had been achieved by its members in overcoming the defects of that material. Speed was of very great importance in ironclad ships; but coal-carrying capacity was of quite as much importance if not more, and unless more attention was paid to this point in future the utility of our fleet would be impaired.

Mr. Barnaby said that Mr. Samuda had, he feared, over rated the value of steel-faced armour. It was not one-third better than iron. The Admiralty experiment showed that it was about one-fourth stronger.

Sir E. J. Reed held that Mr. Samuda need not have made his ship so short, and blunt, and hard to drive. When armour on the bow and stern had been given up it was possible to use good lines. It was true that when a stout steel deck 4ft. below the water-level was put into a ship it added as much to her weight as a good deal of bow and stern armour, but in the design before them the deck was only 1½in. thick. If the naval architect confined himself to a stout central citadel he might have a very easily driven ship. But he would like to know how much speed a ship with an unprotected bow would have after that bow had been injured by an enemy's shot or shell. He then proceeded to criticise the design of the Inflexible, for the benefit of Mr. Barnaby and Mr. White, who heard what he said with silent gestures of dissent, and at length Lord Ravensworth came to the rescue by reminding Sir E. J. Reed that time was pressing.

In replying on the discussion, Mr. Samuda explained that much of the design was settled by those for whom the ship had been built. He fully anticipated a speed of 14 knots, which he thought would be very good, and the ship could steam 4000 miles at 10 knots without re-coaling—no insignificant performance. His statements concerning armour were based on information supplied to him by the makers of it, who said that, as a general result of trials, 9in. of steel-faced armour were equal to 12in. to 13in. of iron armour; and besides, the steel armour always broke up the projectile, which was more than iron would do. As regarded injuries to the bow, the ship was no worse off than many of the finest ironclads in the world, such as the Inflexible and Agamennon.

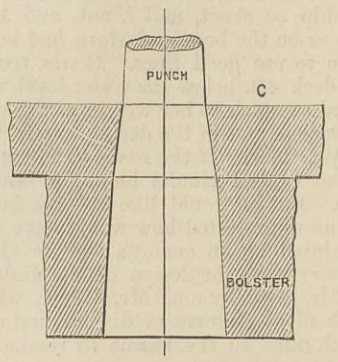
A vote of thanks having been passed to Mr. Samuda, Mr. John apologised for the absence through indisposition of Mr. W. Parker, chief engineer surveyor of Lloyd's, and in his absence read that gentleman's paper,

### On the Peculiarities of Steel Plates Supplied for the Boilers of the Imperial Russian Yacht, Livadia.

This paper, as was to be expected, attracted great attention, and the hall was crowded. It is to be regretted, however, that no representative of Messrs. Cammell, of Sheffield, the makers of the plates in question, was present. Mr. Parker began by calling attention to the steady increase in the employment of steel for boilers, and then went on to two points open to doubt, namely, the rate of corrosion of steel plates, and secondly, the chance of meeting with brittle plates. On the latter point he might state on his own experience, and on the authority of all the engineer surveyors of Lloyd's, that not one single instance of a brittle steel plate had come under their notice during the manipulation of 17,000 tons of steel; and it was not until the peculiar behaviour of the plates of the Livadia's boilers occurred that they had any fear on the score of brittle plates. During the construction of steel boilers much was heard of mysterious fractures in steel plates which had stood all the tests required, been rivetted up into their places, and had then, as it was termed, cracked without being touched. A great number of these cases had been investigated, and in every instance they had been clearly traceable to improper manipulation of the material, and the plates in the vicinity of the fracture were found to be perfectly ductile after the fracture had relieved the strain upon the material. These cases were quite as numerous in steel manufactured by the Siemens process as by the Bessemer process. They were clearly shown to be due to internal stresses set up in the plates by improper manipulation, and under certain conditions a tearing action was set up.

The fractures of the steel used in the boilers of the Livadia were entirely different from anything they had previously had experience of, and they had still later experience of other steel behaving in the same way, and he thought the time had come when steel makers must sift the matter to the bottom, and not only find out the cause, but find out the remedy. He then went on to say that he had obtained every facility for testing the plates of the boilers of the Livadia and obtaining other information concerning them. It appears that the plates were specified to be Messrs. Cammell's subcarburised steel, made by the Siemens process, each plate to have a tensile strength of not less than 26 and not more than 30 tons per square inch, with an ultimate elongation of 15 per cent. in a length of 6in. In all there were 154 plates supplied, and from these 219 pieces were cut for bending tests; the cold bending and temper tests were made—and were nearly all satisfactory when made—from the rough shearings, and in those cases where the rough sheared pieces broke before bending to the required curve, duplicate test pieces were planed and properly prepared, when they all proved to be satisfactory. There were also fourteen tensile tests made at the works, the tensile strength varying between the limits of 26·1 and 28·3 tons per square inch, the elongation in 8in. varying from 27·3 to 34·3 per cent. The tabulated results of these tests, supplied by Messrs. Elder and Co. and Messrs. Cammell and Co., are set forth in the tables. On the arrival of the plates at Glasgow, Messrs. Elder, for their own satisfaction, had some check tests made, which practically corroborated those previously made at the steel works. The Livadia, it may be mentioned, was intended to be fitted with eight double-ended and two single-ended cylindrical boilers, each 14ft. 3in. diameter by 16ft. long and 8ft. 6in. long respectively, constructed to work at a pressure of 70 lb. per square inch, the shells being of steel, and the internal portions of iron. The shells were ¾in. thick, made in three courses of plating — lap-jointed, treble-rivetted in the longitudinal seams, and double-rivetted in the circumferential seams, as shown in Fig. 2 and 4, and would be eligible, by the rules of Lloyd's Register for determining the safe working pressure in marine boilers, to work at a pressure of 75 lb. per square inch. The plates were all punched, the holes being about $\frac{1}{16}$in. less diameter than that of the rivets, then slightly heated and bent to their required curvature, and afterwards put together and

the rivet-holes rimed out fair to the finished size in place. While under this treatment one of the plates accidentally fell from the slings on to a piece of metal, which indented it considerably, but did not crack or injure it in the




Punch and Bolster used by Messrs. Elder,—Half Size.

vicinity of the indentation, but it was observed that the plate had cracked at a number of the rivet holes. Messrs. Cammell were in consequence communicated with, and Mr. Alexander, their representative, who examined this plate, gave it as his opinion that the plates had all been injured by punching, and should be properly annealed to restore the material to its normal condition. Accordingly the plates were all sent to the makers' works at Sheffield, and annealed in a furnace which had been specially altered for this purpose. A sketch of this furnace, and of the position of the plates while being annealed, is given in Fig. 1. The plates were afterwards returned to Glasgow, and rivetted up in their places, and the boilers completed without any further cause for alarm. On subjecting the first boiler to hydraulic pressure, before the test pressure of 140 lb. per square inch was reached, the boiler shell tore asunder in three places, the cracks appearing to have started amongst the rivet holes of the longitudinal seams, and to have extended at the back of the rivet holes across the plate—see Fig. 4. In the second boiler, which it was intended to test, the shell plates were found to be cracked in a similar manner behind the rivet holes, before any water had been put into the boiler. Mr. Bryce, the manager of the engineering department of Messrs. Elder's works, at once gave instructions to cut the whole of the steel shells from these boilers, and they were replaced by others made of steel manufactured by the Steel Company of Scotland. These plates, which were worked in precisely the same manner, gave no special trouble in working, and the boilers proved to be satisfactory under test. On examination of the cracked or torn shell plates they were found to be extremely brittle; large pieces were easily broken off by one blow from an ordinary sledge hammer. In other words, here was a material which had satisfactorily withstood all the mechanical tests recognised by Lloyd's Registry, the Admiralty, and the Board of Trade, as sufficient to determine its suitability for the purpose for which it was being used, and was now shown to have become as brittle as cast iron, or even more so, after having apparently undergone only the working usual in boiler making. Chemical analysis was resorted to as being likely to throw some light on the subject, and the results are set forth in Tables A, B, and C. They do not show any reason why the

Table A.

*Analysis of a Sample of Steel Plate received on the 2nd instant from Messrs. John Elder and Co., Fairfield, Govan.*

| | Per cent. |
|---|---|
| Iron | 99·116 |
| Carbon, combined | ·130 |
| Carbon, graphite | absent |
| Manganese | ·600 |
| Sulphur | ·082 |
| Phosphorus | ·072 |
| Silicon | mere trace. |
| | 100·00 |

Table B.

*Results of Analyses made by six eminent Metallurgists on Samples of the Steel Plates which failed in the Boilers of the Livadia, and of Analyses made on Samples of good Boiler Steel.*

| | Livadia boiler steel. | | | | | | Good workable steel. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | K |
| Carbon | ·063 | ·077 | ·100 | ·120 | ·125 | ·127 | ·104 | ·140 | ·160 | ·165 |
| Manganese | ·543 | ·640 | ·432 | ·420 | ·662 | ·552 | ·290 | ·641 | ·304 | ·684 |
| Sulphur | ·064 | ·092 | ·080 | — | ·073 | ·094 | ·064 | ·056 | ·048 | ·084 |
| Phosphorus | ·063 | ·064 | ·045 | ·063 | ·060 | ·050 | ·070 | — | ·055 | ·060 |
| Silicon | ·015 | ·046 | ·063 | ·028 | ·020 | trace | trace | — | — | trace |

Table C.

*Analysis made by an eminent Metallurgist on a Sample of the Steel which failed in the Boilers of the Livadia.*

Shavings about $\frac{1}{16}$in. thick were taken off in successive layers through the thickness of the plate, and carefully analysed for manganese, carbon, phosphorus, and sulphur, with the following results:—

| | Mangan. | Carbon. | Phosphor. | Sulphur. |
|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | Per cent. |
| 1st $\frac{1}{16}$in. cut. | ·280 | ·100 | ·040 | ·054 |
| 2nd ,, | ·230 | ·110 | ·054 | ·065 |
| 3rd ,, | ·367 | ·120 | ·069 | ·080 |
| 4th ,, | ·410 | ·150 | ·076 | ·131 |
| 5th ,, | ·283 | ·160 | ·077 | ·097 |
| 6th ,, | ·283 | ·180 | ·079 | ·123 |
| 7th ,, | ·348 | ·160 | ·072 | ·066 |
| 8th ,, | ·381 | ·190 | ·074 | ·105 |
| 9th ,, | ·371 | ·200 | ·095 | ·177 |
| 10th ,, | ·237 | ·180 | ·086 | ·118 |
| 11th ,, | ·288 | ·180 | ·079 | ·098 |
| 12th ,, | ·237 | ·160 | ·076 | ·090 |
| 13th ,, | ·360 | ·110 | ·050 | ·052 |
| 14th ,, | ·381 | ·090 | ·039 | ·018 |

material should behave in an anomalous manner. When the portion of boiler shells was received in London, one of the fractured plates was separated from the other plates by carefully drilling out the rivets connecting them, and several strips were sawn cold out of the defective plate for testing purposes from the positions shown in Fig. 3. Of these strips, two, each of 1in., 1½in., and 2in. width respectively, were tested by Professor Kennedy, of University College, for tensile strength and elongation, with the results shown in Table D—specimens *B*, *C*, *D*, *E*, *F*, and *G*. The results seemed to be everything that could be desired, so far as tenacity and elongation are concerned; but the fractures appeared to be altogether different from those usual in good steel—distinct signs of lamination, peculiar colour, and crystallisation being entirely new features. Other strips about 4in. wide—*a*, *b*, *c*, and *d* in Fig. 3—were taken and subjected to bending tests. They were each found to be extremely brittle in proximity to the rivet holes, breaking across at the holes with one blow from the hammer, while but a short distance from the holes the strips bent cold to the same curvature as would be expected in ordinarily good steel; and on one of the strips being raised to a white heat, and allowed to cool, it was bent nearly close without any signs of fracture.

specimen broke at a stress of 27·6 tons per square inch, with an elongation in 8in. of 7·5 per cent. The annealed specimen stood 26·6 tons per square inch and stretched 6 per cent. in the same length, and the plate punched piece broke short off with no extension under a strain of 18·4 tons per square inch.

A narrow strip was cut from the plate next to that previously experimented upon, from a part of the plate remote from any of the rivet holes, and it was found to be extremely brittle. The fracture of this piece presented a very peculiar appearance. The outside sixteenth of an inch on one side presents mirror-like facets from ⅛in. to ¼in. wide, the rest of the fracture being of a fine granular, crystalline, but striated appearance. This outer layer was very soft, being easily nicked or cut on the edges by a penknife, and, as would be observed from the analysis, it contained no carbon, while the layer immediately below this

Table D.

*Report on Tests conducted by Professor Kennedy in the Engineering Laboratory, University College, on Samples of Steel cut from the Boiler Plates of the Imperial Russian Yacht "Livadia."*

| Date. | U.C.L. Test No. | Dimensions. Breadth | Thickness. | Area. | Limit of elasticity. Tons. | Breaking load. Tons. | Percentage of Extension. | Position in plate. See Fig. 2. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| 1880. | | In. | In. | Sq. in. | Sq. in. | Sq. in. | | | |
| 28th July | 469 | 0·672 | 0·667 | 0·448 | 17·9 | 29·4 | 19·8 in 3in. | A | Uniform finely granular "cup" fracture, with silky lustre. |
| 2nd Sept. | 485 | 0·997 | 0·744 | 0·742 | 17·48 | 29·48 | 21·6 in 8in.*<br>26·5 in 6in. | B | Fracture, about 5 per cent. crystalline, the rest silky. Lamination distinct with longitudinal splitting, and distinct appearance of defective weld.<br>Scale removed before testing, one side only, by hammering and rough filing. |
| | 486 | 1·000 | 0·742 | 0·742 | 18·2 | 29·75 | 20·2 in 8in.*<br>23·0 in 6in. | C | Fracture silky, slightly specked with crystal. Lamination quite distinct and traces of splitting.<br>Scale removed as No. 485 before testing. |
| | 487 | 1·499 | 0·659 | 0·988 | 18·15 | 29·82 | 19·5 in 8in. | D | Fracture silky, specked with crystal. Lamination very distinct. A pale salmon-red colour is very distinctly noticeable over a part of the fracture, but only in one of the two broken ends.<br>Planed all over one side to take out a flaw. |
| | 488 | 1·497 | 0·742 | 1·111 | 15·43 | 29·86 | 18·9 in 8in.*<br>22·0 in 6in. | E | Fracture, about 75 per cent. crystalline, and very distinct lamination throughout.<br>Scale removed as No. 485 before testing. |
| | 489 | 1·994 | 0·656 | 1·308 | 16·93 | 29·79 | 23·9 in 8in.*<br>28·2 in 6in. | F | Fracture, about 20 per cent. crystalline, remainder silky. Lamination very distinct.<br>Planed all over one side as No. 487. |
| | 490 | 1·994 | 0·656 | 1·308 | 16·04 | 30·20 | 23·1 in 8in.*<br>28·0 in 6in. | G | Fracture, about 30 per cent. crystalline, remainder silky. Lamination very distinct.<br>Planed all over one side as No. 487. |
| 3rd Sept. | 491 | 0·742 | 0·674 | 0·500 | 18·93 | 29·25 | 4·68 in 5in. | H | This piece was of the form sketched in Fig. 3, cut obliquely across plate between rivet holes. It was machined at the sides to remove all injury or marks from rivet holes which reduced it to the dimensions given.<br>† Fracture quite square across, and entirely—and somewhat largely—crystalline. |
| 30th Sept. | 523 | 0·773 | 0·500 | 0·386 | 18·88 | 30·58 | 16·8 in 5in. | I | † Fracture granular and silky, lamination visible, and slight splitting. Specks of crystal just visible.<br>Specimen cut diagonally across lap of plate as No. 491—see Fig. 2. Tested as received, machined all over.<br>Scribed with centre line and cross lines ¼in. apart before testing. |
| 1st Nov. | 557 | 1·245 | 0·361 | 0·449 | 20·38 | 33·01 | 11·9 in 8in. | X | Fracture of the ordinary "stepped bevel" shape, showing nothing unusual except a very slight trace of longitudinal splitting.<br>The specimen was not annealed. |
| 1881. | | | | | | | | | |
| 14th Feb. | 680 | 1·242 | 0·350 | | 13·26 | 32·31 | 17· in 8in.<br>29·5 in 2in. | X | Annealed.—Trace of glassy substance which looks black through microscope in fracture. |
| | 681 | 1·272 | 0·366 | 0·466 | 13·41 | 34·26 | 11·25 in 8in.<br>27·5 in 2in. | X | Not annealed.—The specimens 557, 680, and 681 were cut from a plate which had been rolled down from ¾in. to ⅝in. |
| *The following Tests were conducted by the Society's Engineer Surveyor at West Hartlepool.* | | | | | | | | | |
| 1880, 27th Oct. | — | 3·75 | ·75 | 2·062 | — | 18·4 | none in 8in. | *g* | Two holes 1in. diameter punched on centre line. Not annealed. |
| | — | 3·75 | ·75 | 2·062 | — | 26·6 | 6·0 in 8in. | *h* | Two holes 1in. diameter punched on centre line. Annealed. |
| | — | 3·75 | ·75 | 1·875 | — | 27·6 | 7·5 in 8in. | *i* | Two holes 1¼in. diameter drilled on centre line. Not annealed. |

* Note.—As the specimens were made, the 8in. length was between shoulders, and included fillets of ¾in. radius at each end. The extensions on 6in. are therefore given in addition.

† Note.—It was particularly noticeable that these two pieces pulled themselves into sinuous curves. This indicates to some extent how greatly the material must have been strained by the formation of the rivet holes.

In order to ascertain the effect of punching on the material, several holes were punched in these strips, and without exception it was found that the strips immediately became as brittle as the material in the vicinity of the original holes in the boiler, one blow being in every case sufficient to break them across the breadth of 4in., and no perceptible bending being produced before fracture. Pieces were then taken and holes punched therein; one piece was annealed after punching, in another the holes were rimed out ⅛in. larger in diameter than the large side of the punched holes, and in a third piece the holes were drilled. In each case these samples bent to right angles across the holes without fracture. Similar pieces were prepared from steel made by the Steel Company of Scotland, the Landore-Siemens Steel Company, and the Parkhead Steel Company, but in these cases the punching seemed scarcely to affect the bending capabilities of the material, the strips with punched holes bending to the same extent across the holes as the unpunched strips.

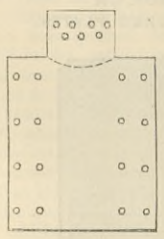
These experiments were afterwards corroborated by cutting off parts of the original joint of the plate from which the rivets had been drilled out, and striking each piece light blows with a hammer, which broke them easily into small pieces, but on the material from the same locality being annealed it was found to bend almost double even across the holes—see Fig. 3, specimens E and F. A portion of the unpunched plate was also taken and holes punched in it of the same diameter and pitch as those in the boiler seam, and it behaved in a precisely similar manner—see Fig. 3, specimen F. A piece of plate was annealed before the holes were punched; it was also nearly if not quite as brittle as the unannealed piece, and a further piece annealed after punching was found to bend well—*vide* specimens K and L. The author then went on to describe other tests. It being thus found that punching holes in the plates made them extremely brittle, some specimens were prepared to ascertain the effect of that operation on the tensile strength of the material. A piece of plate was punched with two rows of holes and then sawn into strips, each strip containing two holes. In one strip the holes were rimed out, another was annealed, and the third was plain punched. On being tested, the rimed contained a little, the inside of the plate containing more.

All the other specimens that were tested for tension presented an entirely different appearance from those of steel that had worked well; some of the fractures were crystalline, whilst in the same fracture other portions were silky, others were filled with distinct laminations and cracks, and the colour of the fractures was quite different from the beautiful dark grey so marked in specimens of good steel. The peculiar appearance of the specimens suggested the idea that the plates might have been produced by rolling them from a slightly spongy ingot, the vacuities or air cells in which had been closed up during the operation of hammering and rolling, but the sides not perfectly united. It was also suggested that the plates might not have had sufficient mechanical work upon them, either by being cast in flat ingots and rolled direct into plates, or by cogging the ingots down to the thickness of the slabs instead of hammering them. Accordingly a piece cut from the fractured plate was raised to a red heat and rolled to half its original thickness—Fig. 3, specimen X. Strips were then cut from this ⅝in. plate and punched with holes ½in. diameter, being one-half the size of those in the ¾in. plate. This extra work on the material seemed to raise its ductility appreciably, the strips being found to bend well after punching, several of them bending to right angles and only one of them breaking short off, while none of them showed such extraordinary signs of brittleness as were observable in the material when of the original thickness.

The conclusions arrived at from this investigation may be summarised as follows:—(1) That there is nothing in the chemical analysis of the material, beyond the want of uniformity described, to account for its behaving in an anomalous manner, and that, so far as can be discovered, the raw material used seems to be of a suitable quality. (2) That the material as first rolled into plates stood the tests required by the specification, and also those prescribed by Lloyd's Register, the Admiralty, and the Board of Trade, the tensile stress, the elongation, and the bending tests being quite satisfactory. (3) That the tensile strength of the material was not reduced by punching to a greater extent than is usual with mild steel, but that

the plates when punched—whether one hole in a strip or several holes along the edge of the plate—became extremely brittle for some distance from the holes. (4) That the appearance of the fractures, especially in those samples broken by tension, showed that the material had not had sufficient mechanical work bestowed upon it, a number of minute laminations, cracks, and longitudinal splittings being distinctly visible in the specimens; and this defect, together with punching, made the material entirely unfit for employment. (5) That further working of the material, to the extent required to reduce its thickness to one-half, appears to have nearly, or entirely, eliminated the cause of the brittleness. (6) That, in order to avoid the use of similar plates in future, the fractures of test pieces should be carefully observed, and should any of them present an unusual appearance, further bending tests should be made on strips having holes punched in them of a diameter about $1\frac{1}{4}$ times the thickness of the plates.

Since completing the foregoing investigations, and arriving at the conclusions set forth, it had been the author's duty, he said, in company with his colleague, Mr. John, to inquire into another series of failures of plates, this time used for shipbuilding purposes. The material had been supplied to Messrs. W. Denny and Brothers, Dumbarton, by the West Cumberland Steel Company, Workington, and as some of the plates had fractured in a somewhat alarming manner, they were directed by the committee of Lloyd's Register to investigate the subject. They were shown a couple of these fractured plates at Messrs. Denny's yard, one being a bow plate represented by the annexed sketch, the dotted lines showing the fracture; the other a plate from above the boss which cracked through the landing edge. A strip about $3\frac{3}{4}$in. broad was cut from the latter, the strip being in the rough, sheared on one edge and punched on the other. Being placed on an anvil, when struck with a hammer it broke off short. This plate was $\frac{1}{3}\frac{5}{2}$in. thick, and broke at a tensile strength between 31 tons and 32 tons per square inch, with an elongation varying from 20 to 25 per cent. Having broken this strip off short with a hammer in its rough state, edges were planed down to remove those portions injured by the punching and shearing, when it bent over to a radius of $\frac{7}{8}$in. without fracture. A $\frac{3}{4}$in. hole was then punched in the same piece, and after this it broke again short off with a blow from the hammer. It was evident from this that the material resembled in its defects the steel which failed in the Livadia's boilers. The specimens were sent to the steel works, and Mr. Snelus frankly admitted that the material was not such as it should be, or such as he would knowingly have sent out from his works. No doubt the material was made by the Siemens process, the ingots were of a reasonable size, and were hammered down into slabs in the usual way. Further tests were made in duplicate, all tending to show that with more work on the plates they improved, and that this was the case in spite of great variations in the temperature during rolling. The experiments also showed that when the plates were so rolled down they did not break off short when it was attempted to bend them across punched holes. In fact they bent to a considerable angle before showing signs of fracture at the holes, which then opened gradually, instead of going suddenly right across. The author regretted to say that they had since heard of further failures of this material in the same way. How far the greater or less amount of work done on plates in reducing them from the ingots is accountable for the failures and peculiarities which have recently come to light is a question of the utmost moment, and it is one which should be thoroughly investigated. Mr. Webb, of Crewe, laid it down some years ago that the ingot should be at least twenty times as thick as the plate to be produced from it, and he had doubtless sound reason and experience to guide him in his decision. Whether, however, an inch steel plate rolled from a 24in. ingot would be in the same condition as a $\frac{1}{2}$in. plate rolled from a 12in. ingot, is open to question. In more than one case during a recent visit to a number of steel works the author had the pleasure to hear manufacturers express their perfect readiness to incur considerable expense in experiments rather than leave this question in its present unsettled state. The remarkable variation in the distribution of the carbon, phosphorus, and other constituent elements was a point that must also be accounted for, and its true significance ascertained, and the testing should be of a more varied and elastic nature than at present. The appearance of the fractures should be carefully watched, and where any departures from the well-known silky fracture common to good mild steel appeared, the plates should be subjected to further bending tests on strips in their rough sheared condition, with holes punched in them, and in any other way that hereafter may be shown to be efficacious in discovering untrustworthy material.



It is much to be regretted, we think, that the discussion which followed this valuable paper was not worthy of it, the speakers entirely ignoring some of the more remarkable features in the performance of the steel criticised. Mr. Kirk, of Messrs. John Elder and Co., was the first speaker. He said he had been asked by Mr. Parker to make some tests, and he had done so. The first thing which came out was that the plates would bear very little manipulation. A strip about a foot long, slightly bent, would not bear straightening cold by gentle pressure. It cracked at once; but when heated and forged into a bar $\frac{7}{8}$in. square it was so much improved that the bar could be bent cold on itself, so he thought that the material was good but the manufacture bad. He then took some Siemens-Martin plates and tried to spoil them; he could injure them, but not make them as bad as the Livadia plates. Annealing might improve or spoil plates according to how it was done. He showed a sample strip of the original metal bent cold on itself without crack. A second sample, equally good, had been left in a forge furnace for twelve hours, the damper being down, and the air excluded; the plate was uninjured. Two other samples heated in much the same way, but with the doors open and dampers up, so that a current of air passed through the furnace, were spoiled. A good plate could not be improved by annealing.

Mr. Thorneycroft said that if they would look at the drawing of the annealing furnace—Fig. 1—they would see that the plates had been so stacked on each other that uniform heating was impossible. The more work was put into steel the better. He used large quantities of thin steel—$\frac{3}{16}$in., and it was usually tougher and better than thicker plates.

Dr. Siemens, who spoke next, succeeded in attracting no small attention by making a most extraordinary statement. It is well-known that he is rather given to surprising his hearers, and he must have been satisfied by the expression of blank amazement with which those present heard him assert that annealing steel plates did them no good. He began by saying that the performance of the Livadia plates was so extraordinary, that he had asked for and obtained a sample for analysis. He could break the plates up with a hammer. The chemical composition was extremely irregular; and Mr. Parker had omitted all mention of one element, silicon, which was present to the extent of ·03 per cent. Phosphorus was twice as great in quantity on one side of the plate as on the other. How did that come about? Was the ingot all of the same metal? He was forced to conclude that the treatment which the ingot received greatly injured the metal. Mr. Kirk had explained how steel could be "burned." He should like to know how much oxygen had been absorbed by the Livadia plates. As for annealing, mild steel should not be annealed. It ought to be able to bear punching without any loss of strength, and should not require annealing. On the contrary, it was well known that punching increased the tensile strength per square inch of mild steel. This material ought to stand any kind of rough treatment cold. If it was heated and forged in any way, however, it might be annealed with advantage. If the metal was weakened by punching it ought to be rejected. His experiments showed that whenever mild steel was squeezed in any way, as by the action of a punch, it became stronger. He had no sympathy with annealing after punching. Much information was wanted as to the size of the Livadia ingots. If they had been allowed to stand all night in the fire the steel made from them was open to great suspicion. The annealing of steel plates ought to be done a plate at a time, not heaped on one another as shown in the drawing. As for the West Cumberland plates, he did not think they had been made by his process.

Mr. Denny said that as regarded his plates part had been made by the Siemens-Martin process and part by the Bessemer process. He could not say which had failed. He had come to the conclusion that it was incumbent on himself and shipbuilders generally not to give orders to firms who supplied defective plates. This was the only way to compel steel makers to supply a trustworthy material; and he for one would never consent to take a plate from a firm which supplied untrustworthy metal. The steel makers must look to themselves. Working mild steel did not improve it. The plate referred to by Mr. Parker had been cottered up, and next morning was found broken. Thin steel—$\frac{3}{16}$in. from the Cumberland Company's works stood splendidly. This opened his eyes to the fact that thin steel behaved differently from thick steel. In future tests ought to be increased in severity.

Mr. West said that 20,000 tons of steel plates had passed through his hands, and with comparatively satisfactory results. There were no failures even with the high tension steels, whose adoption he had advocated last year. They would have to be content with punched holes for ships, and he was of opinion that punching did not injure good steel in one sense. He had also found that if a strip of Bessemer steel were bent at right angles, and then straightened, its tensile strength would be augmented. He feared that in the case of the Livadia the original tests had been perfunctory. As for annealing the plates after they had cracked, it was locking the stable door after the horse had been stolen. A 22in. ingot was quite large enough to make a $\frac{7}{8}$in. plate out of.

Mr. Samuda had heard Dr. Siemens with some astonishment. Every now and then they came across a hard plate, and annealing made it soft and ductile; but as a general rule he did not think annealing should be practised unless the plate had been heated in one corner or somewhere. Questions of price should not be allowed to affect the quality of steel.

Mr. Martell held that while steel was better than iron, it would be foolish to shut our eyes to the fact that mysterious failures do occur. There was a mystery about mild steel which there was not about iron. The size of the ingot had a great influence. One steel manufacturer had tried to roll plates out of steel slabs, and had entirely failed. Mr. Webb, of Crewe, a man of great experience, said he could not get a sound plate from an ingot less than 24in. square. That was an important statement. He could not restrain the expression of his astonishment at Dr. Siemens' assertion that punching did not weaken steel; it was contrary to all experience. Steel makers must not delude themselves by testing planed and filed samples, but rough samples, showing how the metal was handled in the shipyard. Confidence had been shaken, and must be restored by the steel makers.

Sir Spencer Robinson said that his somewhat limited experience as a director of a small shipbuilding company at Hull was most satisfactory. They used plates made by the Steel Company of Scotland for both ships and boilers with uniform success. He was surprised by Dr. Siemens' statements; all his own experience was that annealing restored the strength to punched plates.

Mr. E. A. Cowper criticised the construction of the annealing oven, which he said was quite wrong in principle; some of the plates must be burned if the others were to be made hot enough.

Mr. Merrifield said that all his experience went to show that before a good tough plate could be got the original texture or structure of the ingot must be entirely broken down. This was true of wax, lead, copper, and steel.

Mr. White cited a case in which the manufacturer of some 2in. deck armour plates tried to roll them from cast steel slabs without success. A plate might be worked too much. He had met with brittle $\frac{3}{16}$ plates, which were made tough by annealing. Beams as much as 65ft. long, rolled in one piece, were sometimes found to be brittle at one end. He had every confidence in steel, but the makers must be cautious. Punching injured steel, notwithstanding Dr. Siemens's assertions to the contrary. 28-ton steel became 27-ton or even 26-ton steel after punching. Tests now made were not rough and severe enough.

Mr. Laird remarked that the cause of the fracture of Mr. Denny's plate was probably that it had been heated to bend it. He had had a somewhat similar experience with a heated plate.

Dr. Siemens now asked permission to explain that his statements were based on experiments which he had made.

Mr. Jameson stated that the ordinary practice when he was at Messrs. Elder and Co.'s works was when steel plates for boilers came in after they had been tested at the works, to re-test them. They were then punched and subsequently planed, at the sides and ends, then annealed, and afterwards bent in the rolls and cooled down in the shops. The plates of the Livadia boilers had behaved differently from other plates, and he wanted steel makers to tell him why.

Mr. Pearce said that Dr. Siemens assertions were contrary to all experience, and he could not accept them. Punching injured steel, and they must anneal after punching. This was also specially true of plates any portion of which had been heated even slightly, as, for example, if a small corner were put in the fire. But all boiler plates ought to be drilled, and Messrs. Elder now did so treat their boiler plates. For every steel plate which had failed it should be remarked that twenty iron plates had done the same.

In reply, Mr. John regretted that no representative of the makers of the steel plates which had failed was present. The plate which gave way at Mr. Denny's was Siemens-Martin steel; for he himself had heard Mr. Snelus say that for ten years he had made Bessemer plates without a failure, and the moment he began to make Siemens steel he got into a mess. Tests should be on rough, not on planed plates. There was a great deal about steel yet to be learned. For example, although it was said that the Livadia's plates were bad because they were not worked enough, it was difficult to maintain that, in face of the fact that the little test ingot taken from the Bessemer ladle, the "baby" ingot, gave admirable metal.

A vote of thanks was passed unanimously to Mr. Parker.

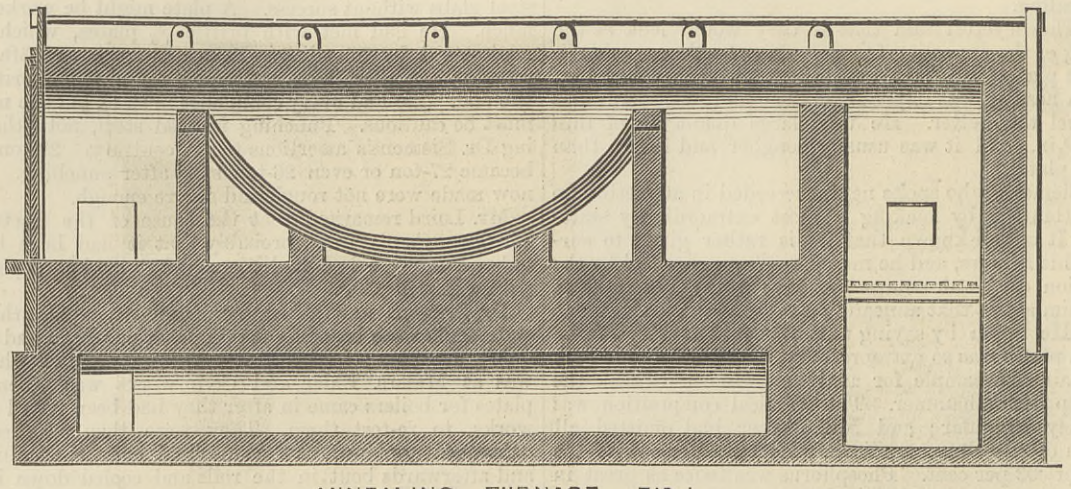
The next paper read was by Mr. John R. Ravenhill.

### Twenty Minutes on the Increased Use of Steel in Shipbuilding and Marine Engineering.

The paper was accompanied by numerous tables, for which we cannot find space. We give the most interesting portion of it. Steel as a material for the hulls of moderate-sized vessels, although of a very different description to that now in use, was successfully adopted in the commercial marine in the year 1859. The Jason, of 452 tons O.M., was built by Messrs. Samuda Brothers for service in the Black Sea, and in 1860 the well-known Dover Mail Packets were constructed for the London, Chatham, and Dover Railway Company. Steel for the construction of marine boilers was first used by the Admiralty in 1857, the plates for them being manufactured by Messrs. Shortridge, Howell, and Jessop, but the results were far from satisfactory. Steel boilers were about the same time introduced into the commercial marine, but with very conflicting results, although it was right, perhaps, to say that there are land boilers now working at high-pressure that were made of steel under the Bessemer process, about the same date, which have given and are giving every satisfaction. As regards the above-named steamers, they fully justified the anticipations of those who advised their owners to adopt a then quite new material, and no vessel could have undergone a severer test as regards strength of material than the Samphire did within a very short time of her being afloat; but the great cost of the production of the material militated against its becoming more generally introduced, notwithstanding the successful results obtained. The shafting on board the Samphire was made of puddled steel by Messrs. Thomas Firth and Son, the diameter of shaft necks being 10in. The improvements introduced since that date in the Bessemer process, coupled with the introduction of the Siemens-Martin principle, had entirely changed the aspect as regards the future use of steel-plates. They were first used by the Admiralty for inboard work on board the Bellerophon in 1863.

Crank axles of the same description of puddled steel, by the same makers previously alluded to as having supplied the shafts for the Samphire, gave every satisfaction on board many vessels from the author's experience, but they were then only in the position to manufacture them up to a comparatively small size for marine work, and the sad disappointment that attended the fitting of three large crank shafts on board some celebrated mail packets that were supplied by a celebrated foreign establishment, together with failure in one or two other instances, retarded the further introduction of them on board steamers; but great progress has since been made in the material used for shafting. Whitworth's fluid pressed steel for propeller shafting is well known, and his firm has lately been engaged in making crank shafts, the plan adopted being as follows:—The hollow crank pin is cast in one piece with the blades; each piece of the body of the shaft is then screwed securely into its respective blade, with a key carefully fitted as an additional security, and this plan has found favour with some very eminent engineering firms, and it has been used by the Admiralty. On the other hand Messrs. Vickers and Co., of Sheffield, have done a good deal in cast steel crank shafts, but having regard to the old meaning of the word cast steel, the words

# FRACTURED BOILER, RUSSIAN IMPERIAL YACHT, LIVADIA.



ANNEALING FURNACE FIG. I.

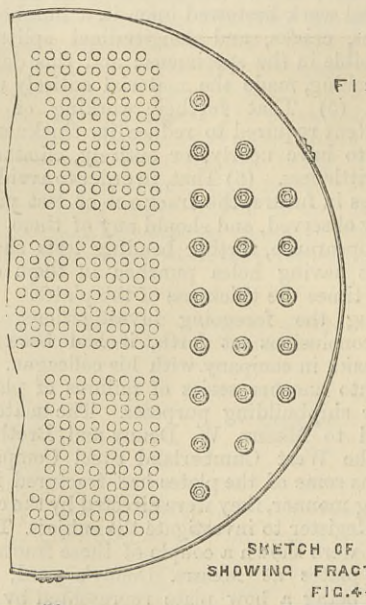
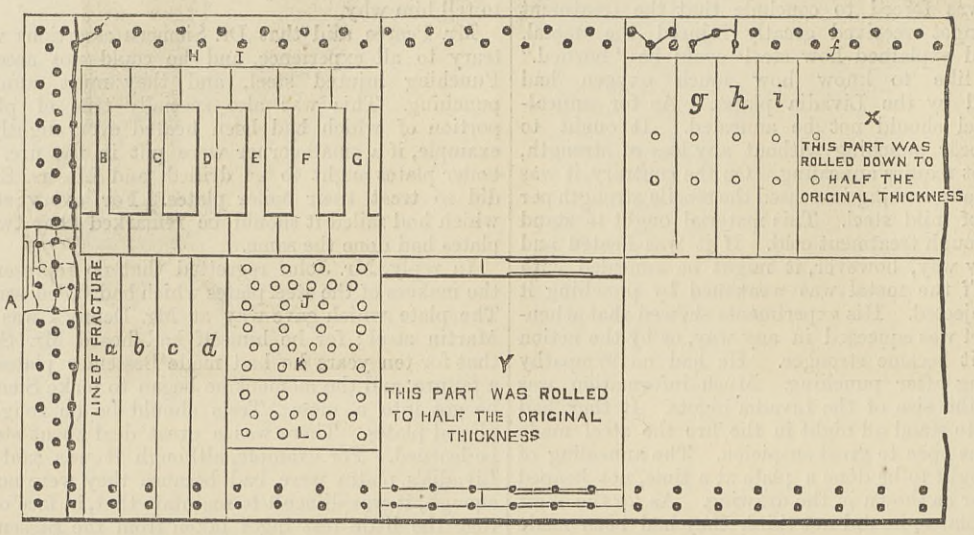


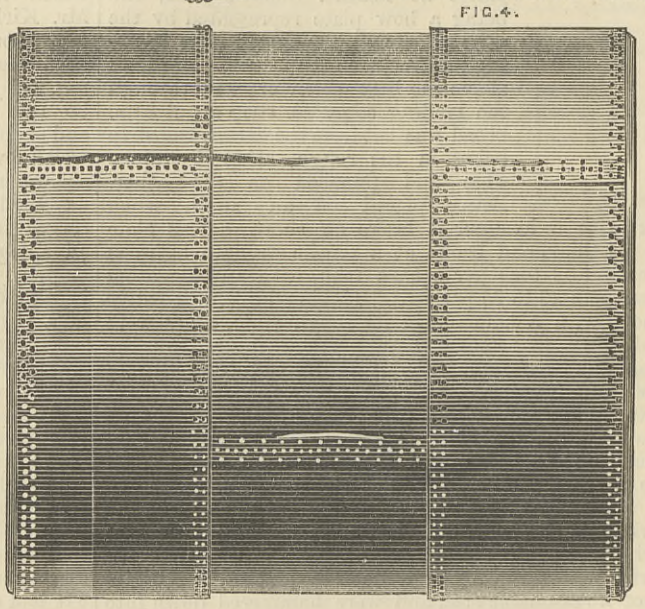
FIG. 2

SKETCH OF BOILER SHOWING FRACTURED PLATES FIG. 4.




SKETCH OF PLATE ILLUSTRATING POSITION OF TEST PIECES

FIG 3



malleable cast steel would, perhaps, be a more correct definition, as they all pass under the forge hammer after leaving the foundry. From personal inspection of a large crank shaft, having a coupling on the end of about 3ft. 6in. in diameter, he could state that over the whole of this large surface, as also of all the surfaces of its blades and crank pin, the metal showed a striking similarity of colour and uniformity of appearance, and they were clean and bright as a looking-glass; very different as regards the inside portions of the crank, from the large crank shafts before alluded to, which showed a very crystalline appearance at their centre. They have forged, in some instances, in one solid piece, in other cases they have adopted the plan largely followed in the North by marine engineers, in building up large wrought iron crank shafts.

Messrs. Vickers and Co., of Sheffield, were the first firm in this country to cast steel bells, and about eleven years ago they turned their attention to the production of cast steel blades for propellers. The Iron Duke, armour-plated, of 6010—3787—tons, and 4270 twin screw—800—horse-power, was one of the first vessels to which they were applied, and they have given during successive commissions the most perfect satisfaction, and are still in good condition. A large number of our commercial steamers have also been successfully fitted with propellers of this material, more especially in the Transatlantic service, where they have been found to be greatly superior to the cast iron ones previously in use; but such is the severity of the work done, that at the end of about three years the blades become so reduced in thickness that they require to be replaced. This same firm have also supplied some steel liners for cylinders for the commercial marine.

The present vast and increasing use of steel is really startling. The number and tonnage of steel vessels, steam and sailing, classed in Lloyd's Register during the years 1878, 1879, and 1880, are as under :—

Table II.

| | Steam. | | Sailing. | |
|---|---|---|---|---|
| | No. of vessels. | Tons. | No. of vessels. | Tons. |
| 1878 .. .. .. | 5 | 2,929 | None. | — |
| 1879 .. .. .. | 6 | 12,473 | 1 | 1700 |
| 1880 .. .. .. | 17 | 27,815 | 1 | 1245 |

The number and tonnage of steam vessels, which, from the information in possession of their office, made up to the 31st December last, appeared to be in course of construction—for they do not all come under their survey—were thirty-four steam vessels, 111,467 tons; two sailing vessel, 1760 tons; as to which tonnage the author may mention that the Orient Company, the Cunard Company, the Peninsular Company, the Union Steamship Company, and others, are all building vessels of steel. As regards boilers, in the spring of 1878 only one steel boiler on board a steamer had come under the notice of Lloyd's Registry since the introduction of mild steel. From that date the number of steamships fitted with boilers either wholly or partially made of steel, by returns also up to 31st December last, were as follows :—

Table III.

| | No. of steam vessels. | No. of tons of steel worked up. |
|---|---|---|
| Between 1st May, 1878, and 30th April, 1879.. .. .. .. .. .. | 120 | about 3,000 |
| Between 1st May, 1879, and 30th April, 1880.. .. .. .. .. .. | 160 | ,, 4,000 |
| Between 1st May and 31st December, 1880 .. .. .. .. .. .. .. | 250 | ,, 7,500 |
| | 530 | ,, 14,500 |

When it is remembered that these figures date back barely for 2¾ years they become very significant.

Availing themselves of an invitation from Mr. Riley, the manager of the Steel Company of Scotland, the deputation from the Institution visited those works, and on passing through the rolling mills and the forge, they were shown steam hammer piston rods of 7in. diameter, that had had their ends welded together after fracture from working, and were told that such repairs had proved to be a success, and also that no difficulty was experienced in efficiently welding together any width of boiler or ship-plates.

The engines of the Leander, now being constructed by Messrs. Napier and Sons, are to indicate 5000-horse power; somewhat in excess of those of the Audacious class, but the large piston of the former being of the same diameter, the comparison is interesting. Assuming the difference in weights to be correct, there is a saving in weight in favour of the Leander pistons of no less than 36 per cent., most valuable as applied to one of the principal moving parts travelling at a speed of 720ft per minute, the engines working at 90 revolutions. Such a saving as 36 per cent. would amount to probably 150 tons in one of our large sets of commercial marine engines, provided the same percentage could be carried throughout, whilst a considerable saving by the substitution of this metal for wrought iron could be, in his opinion, beneficially effected.

The discussion was opened by Mr. Denny, who drew attention to the important question of the corrosion of steel. Last year he had had the honour of bringing before the members of the Institute the case of two screw steamers built by his firm, and which were employed in the brackish waters of the Irrawaddy. They were built of Siemens-Martin steel, and he was happy to tell them, as bearing upon the discussion, that both vessels had been inspected and no corrosion had been found after twelve months' service. In the spring of last year they delivered to the Peninsular and Oriental Company a steel screw steamer, the Ravenna, which was built entirely of steel, with the exception of the stern frame and the rudder frame, which were of forged scrap iron. The week before last he inspected the vessel in dock and found the skin, both above and below the water line, perfectly sound and free from corrosion, but the rudder frame was most seriously pitted, to the depth of over three-sixteenths of an inch. He thought this a very extraordinary result, and well worthy the attention of the Institute, because it seemed to him to go to prove that it was rather a dangerous thing to mix up iron with steel. It seemed to him a curious thing that the water flowing from the skin of the ship should attack by preference the iron plates.

Mr. Wright stated that since steel had been introduced for the purpose of cylinder liners in the Admiralty service, there had been no fractures to give them any trouble.

Mr. Samuda said that cast steel was now being largely used in many useful parts of the engine, and he felt confident that if they could almost entirely remove cast iron, and substitute steel, they should effect a considerable improvement both in work and material.

Mr. Martell stated that at Lloyd's they had admitted steel for various purposes for some time. As regarded corrosion, his experiences had been precisely the reverse of those of Mr. Denny. He had recently seen a steel-built vessel on the slipway under repairs after she had been running for some time, and whilst the rivets appeared to be quite sound, the steel plates at the bolt-heads were quite corroded.

After a vote of thanks had been passed to Mr. Ravenhill, the meeting adjourned till Thursday morning. We must reserve our report of that day's proceedings for our next impression.

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The Foreign Iron Trade.—The iron market is firm in the Nord, the Haute Marne, and the Meurthe-et-Moselle. German sheets from dephosphorised metal, which correspond to the superior soft descriptions selling in Paris at 36f. 37c. per 100 kilos., have been offered in this centre at 30f. on delivery, and No. 21 steel for springs, from the same source, are quoted at 34f. The Belgian steel trade is brisk. Thus, the Angleur Works have successfully tendered for the supply to the Netherlands State Railways of 4000 tons of steel rails, for which 346,727fl., as against 373,304fl. demanded by the Gute-Hoffnung of Oberhausen; 378,711fl. by Bolckow, Vaughan, and Co.; and 391,770fl. by the Rhine Steel Works, Ruhrort. The Liege-Limburg Railway has accepted the tender of Cockerill for the supply of a quantity of steel rails at 40,200fl., as compared with 56,400fl., the price asked by the Rhine Steel Works. Eight lots, each consisting of ten locomotive crank axles, have been carried off in Belgium by German houses. Thus, three fell to the Gusstahl and Waffenfabrick, at Witten; one at the rate of 130f., another at 135f., and a third at 140f. The Graffenberger Gustahl Fabrick, Dusseldorf, secured two of the lots at 139f. 50c., Cockerill obtaining the three remaining ones at 141f. for two, and 142f. 50c. for the third. English prices were much higher, Messrs. Vickers, of Sheffield, sending tenders for four lots at 325f., and four others at 330f. The returns of exports from Belgium for the first two months of the year show a slight decrease under the heads of raw pig, old iron, iron wire, nails, and wrought iron goods, and an improvement in rails, sheets, bar iron, and foundry goods. During the same period the imports of coal fell from 166,923 tons in 1880 to 141,337 in 1881, and the exports from 789,810 to 594,771. On the other hand the imports of coke rose from 2469 to 3760 tons, and the exports from 124,994 to 155,152. Advices from Germany state that English pig iron continues to compete successfully with home products. Bar iron has a downward tendency. Girders and other material for hedges, as well as sheets and iron wire, are in good demand, and the rail mills are fully provided with orders for some time to come; 1200 steel tires have been ordered at Strasburg from the Hœrde Works, by tender, at 304f. 50c., Bochum asking 316f. 62c., and Krupp 326f. 25c.; and 1000 mounted axles are being supplied to the Cologne-Minden Railway at 338f. 90c.—*Liverpool Journal of Commerce.*

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

*(From our own Correspondent.)*

Anticipating the quarterly meetings next week, the leading finished iron firms have reduced their prices 10s. per ton. Earl Dudley's Round Oak bars now stand at £7 12s. 6d., and the bars of Messrs. Barrows and Sons, of Messrs. Phillip Williams and Sons, and the rest at £7. The earliest action followed close upon the receipt of a circular from the colliery offices of Lord Dudley, which made known that his lordship had dropped coal 1s. and slack 6d. per ton.

At about the same time the accountants to the South Staffordshire Mill and Forge Wages Board reported to the joint secretaries of that board that the result of their examination of the books of the twelve selected bar firms was that they found that the average net price of bars in three months ending with the close of February had been £6 12s. 11½d. This was a drop on the quarter of 2s. 7d. per ton; but it was a less drop than that of the quarter before, which was 4s. 2d. The larger drop reduced the wages of the ironworkers in the proportion of 3d. per ton for puddling, which was brought down to 7s. 3d.; but this—the smaller—drop does not carry a reduction in wages. Mill and forge proprietors will, therefore, obtain no relief in wages. What may be the extent of the relief which, supplementing that in coal, they will get in pigs, remains to be seen.

At present the pig-makers have not followed suit with the makers of finished iron. To-day in Birmingham, £2 2s. 6d. to £3 5s. were still the quoted figures for all-mine forge pigs; £2 5s. to £2 7s. 6d. for half-mine qualities; and £1 17s. 6d. for cinder pigs. The last-named, however, might have been bought at from 1s. 3d. to 2s. 6d. less than the figure quoted; and all-mine and part-mine at from 2s. 6d. to 5s. under the prices asked. But consumers were indisposed to buy even at those rates. As much as £3 17s. 6d. to £4 was quoted for Blaenavon hematites, and nothing under £3 7s. 6d. would be taken for Tredegar forge qualities. Makers of these and other high-class sorts made out of this district were not anxious to book at the figures cited; and yesterday the Wigan Company telegraphed to their representative upon Wolverhampton 'Change that current market figures were not acceptable. Nevertheless, consumers of pigs for use both in the forge and the foundry expressed—both yesterday and to-day—their firm conviction that there must be a specific weakening of the pig market at the quarterly meeting.

Alike in Birmingham and Wolverhampton orders for finished iron were difficult to secure. Galvanised corrugated roofing sheets of a good quality were—24 w.g., delivered unpacked in London, £15; and 26 w.g., £17. Sheets required by the galvanisers were yesterday quoted by makers at £7 10s. for singles, £8 5s. for doubles, and £9 10s. for latens.

At the engineering works of the famous Lilleshall Iron Company, Limited, Oaken Gates, Shropshire, there are just now being made two fine horizontal condensing engines for the driving of a couple of new sheet mills which are being laid down at the Swan Garden Ironworks, Wolverhampton, of Mr. Lysaght. The engines are intended to drive the machinery without the intervention of spur gearing. The cylinders are 36in. diameter, 5ft. stroke, and are fitted with equilibrium valves; the condensers and air pumps are fixed on a prolongation of the engine beds, and are arranged to be worked from the back end of the piston rods; the shafts are of hammered iron, 18in. square for the wheel seat, and the cranks are also of hammered iron; the fly-wheels, which are very heavy—55 tons each—are being cast at Mr. Lysaght's own foundry at Swan Garden. A horizontal forge engine, with a cylinder of 25in. diameter and 4ft. stroke, together with a 50 cwt. steam hammer, are also in course of construction for the same works by the Lilleshall Company.

Metallic slates or "shingles" for roofing purposes have just begun to be manufactured on an American principle in Wolverhampton by a United States concern under the title of the Anglo-American Roofing Company.

The Worsley Iron Foundry, near Stourbridge, which has been closed for some time, has now been restarted by Mr. B. Wood, and the new proprietor has begun work under very favourable circumstances. He has large orders for axle-boxes on hand for the East Indian Railway Company, the India State Railway, and the New South Wales Railway. He has also within the last few days received an order from one of the Australian Governments for twenty tons of railway castings per week, extending over thirteen weeks.

An adjourned conference of miners' delegates representing North and South Staffordshire, East Worcestershire, and Cannock Chase, was held in Wolverhampton on Tuesday to further consider the proposed federation scheme for the districts named. It was reported that there was every prospect of the new union being a success. The contribution of the members was fixed at the excessively low figure of one-halfpenny a month.

The contract for the new bronze coinage for Bulgaria having been secured, after a somewhat keen international competition, by Messrs. R. Heaton, of the Mint, Birmingham, that firm began a few days ago to strike the new coins in the presence of the delegate appointed by the Bulgarian Government to supervise the operation. The particular coin now receiving attention is a piece of ten stolinki—equivalent to French centimes—and is of nearly the size and value of the English penny. Both the designs and engravings of the original dies are the work of a Birmingham artist, who has reason to be proud of his success in carrying off the palm against such men as Scharff, of Vienna.

The South Staffordshire and East Worcestershire Institute of Mining Engineers discussed on Monday the question of mutual insurance between coalmasters and colliers. A paper was read on the matter by Mr. W. G. Davies, and at the close of the discussion, the institute determined to invite Mr. Campbell, the author of a well-known pamphlet dealing with the subject, to lecture before the institute. Coalowners' and colliers' delegates are to be invited to attend.

On Wednesday the Mines Drainage Commissioners met in Wolverhampton. The chairman reported that, owing to the illness of one of the law clerks, some complicated accounts between the commissioners and the Earl of Dudley had not been completed, and that until that was done, the business relating to the loan of £100,000 could not be finally settled. In reply to one of the commissioners, the chairman declined, for the present, to make any statement as to the policy which the commissioners intended to pursue regarding the acquiring of existing pumping engines or the purchase of new ones in the new extended Tipton district.

The net profits of the Walsall Corporation Gas Works for the last financial year have amounted to £7068. The total sales have valued £23,400.

## NOTES FROM LANCASHIRE.

*(From our own Correspondent.)*

*Manchester.*—I cannot add much to what I have already written in previous reports with regard to the position of the iron trade in this district. Business in Lancashire would seem to be in a more depressed condition than in any other part of the kingdom, and unquestionably there is at present quite as little buying going on as during the very dullest period of last year. Consumers, as I have many times pointed out, are in large numbers of cases overstocked with iron, and many of them have deliveries yet to come in which they are unable to take. Then in the face of this there is comparatively so little new work in prospect that iron users, who are rapidly getting through the orders they have on hand, are not—although iron is now being offered at prices which cannot leave any profit to makers—at all disposed to purchase on speculation.

There was again an extremely dull market at Manchester on Tuesday. Here and there it was reported that buying had been going on during the result of the recent spurt in prices at Glasgow, but this has been only temporary, and has not affected the market to any appreciable extent. Prices, indeed, on Tuesday were lower than last week, both in pig and manufactured iron. There was a marked absence of inquiry, except here and there for shipment, and transactions for the most part were limited to very small parcels required for pressing necessities on the part of consumers. Lancashire makers of pig who are accumulating heavy stocks are displaying more anxiety to secure orders. Nominally their quotations for delivery into the Manchester district remain at 45s. for forge, and 46s. for foundry qualities, but these are quotations open to offers where buyers have orders to give out.

In outside brands Lincolnshire and Derbyshire irons are being pushed in this market at low figures. A few of the makers who are still fairly supplied with orders are holding for 45s. to 46s., less 2½ delivered equal to Manchester; but there are sellers at fully 1s. per ton under these figures. For Middlesbrough iron delivered equal to Manchester 46s. 10d. to 47s. 4d. per ton net cash is quoted, but I have not heard of any actual business at these prices.

Finished ironmakers are reported to be getting worse off for orders, and prices influenced by the downward tendency of pig iron are weaker. The reduction in Staffordshire announced this week had already been fully discounted here, but it will still have some effect upon the market. Bars delivered into the Manchester district are quoted at £5 15s. to £5 17s. 6d.; common hoops, £6 5s. to £6 10s.; common plates, £7; and common sheets, £7 10s. per ton.

During the week I have visited some of the principal engineering works in the district, and the reports I have received are not at all encouraging. The principal locomotive builders are not busy, and there are but few new orders coming in. General engineers, who were busy a month back, are now working off their orders, and these are not being replaced. Some of the large machinists are busy, but the work in hand is for the most part for abroad, the orders on home account being very few.

The coal trade continues dull. The principal Manchester firms are maintaining their prices, but in all the principal Lancashire colliery districts there is a downward tendency in the price of round coal; and in most cases reductions of about 6d. per ton have been made this month.

Engine fuel, although just at present tolerably plentiful, is held for late rates as there is every probability that during the summer months slack will be scarce. The average prices at the pit mouth are as under: Best coal, 9s. to 9s. 6d.; seconds, 7s. 6d. to 8s.; common coal, 5s. 6d. to 6s.; burgy, 5s.; and slack, 3s. 6d. to 4s. 6d. per ton. Shipping is very quiet and common has been sold for delivery at the high level, Liverpool, at as low as 6s. 6d. per ton. Coke is in fair demand with prices rather stiffer, local makers in some cases now quoting 12s. to 13s. for common and 15s. to 16s. for large cokes at the ovens.

Messrs. Mather and Platt, of the Salford Ironworks, Manchester, have in hand a quantity of machinery for the South Australian Government for the purposes of mineral exploration, and artesian well boring and pumping appliances in connection therewith. This may be taken as an evidence of the enterprising spirit of our colonists, who seem determined to develope their resources as rapidly as possible. The same firm are also actively engaged in artesian well-boring by their special machinery in various parts of this country for water supply and mineral exploration.

Messrs. Barningham and Co., of Pendleton, near Manchester, are at present executing an order for street tram rails for Italy, together with all the requisite points, crosses, and curves. They have also in hand an order from the Crown Agents for points and crossings which are to be sent to the Mauritius.

The other week I referred to a double-cutting horizontal planing machine which had just been completed by Messrs. J. and J. Kershaw, of Manchester, and which has been illustrated in The Engineer. The firm are now engaged in the construction of machines in which their double-cutting principle is applied to vertical planing. In this machine a carriage works up and down the vertical slide carrying the tool box, and to the vertical slide is fixed an upright rod upon which are adjustable stops for the feed and reversing motion of the tool box. The machine can also be applied to angle or down-cutting, as well as to flat surfaces.

The Inman Steam Company, I understand, is introducing the electric light into its passenger ships, and as an experiment, electric lighting apparatus is being fitted up in the City of Paris steamship. The work, I believe, is being carried out under the superintendence of Mr. Killingworth Hedges, C.E., of London.

Acting under the suggestions of Mr. Joseph Dickinson, H.M. chief Inspector of Mines, Mr. W. H. Bailey of the Albion Works, Salford, has just completed a clock recording apparatus which records automatically over a given period the fluctuations of the ventilation in a coal mine. The clock records on a drum the varying pressure of the air as well as the revolutions of the engine during the week, so that an exact record, beyond the possibility of dispute, is thus kept of the performance of the engine and the actual state of the ventilation. The first of these clocks is being fixed up at Messrs. Brooks and Pickup's Townley Collieries, Burnley.

The principal colliery proprietors in the Manchester district have this week given an advance of wages to their miners equal to about 7 per cent., and to their underground daymen of about 5 per cent. This has been done in accordance with an intimation given to the men during the recent strike that if the advanced prices were maintained wages would also be advanced. In other districts, however, where colliery proprietors have been unable to maintain their prices advances in wages which were put on at the time of the strike are now being taken off, and this anomalous condition of things is sure to create a very unsettled feeling amongst the men.

Two of the most prominent men, who of late years have occupied the position of miners' agents in Lancashire, have relinquished their connection with the miners' unions. Mr. Thomas Halliday, who for a considerable period was president of the Amalgamated Society of Miners, and who has taken an active part in several of the most protracted and serious strikes, has for some time past devoted himself to business pursuits. Now Mr. William Pickard, of Wigan, has followed a similar course. Mr. Pickard, it will be remembered, by his advocacy of the Miners' Permanent Relief Fund as the medium for obtaining compensation for injury or death, in place of the remedies provided by the Employers' Liability Act, incurred very considerable odium amongst the men during the recent strike, and he has now so completely severed his connection with the miners, that he has accepted an appointment as commercial agent for one of the colliery firms in West Lancashire.

*Barrow.*—The inquiries all round in the hematite pig iron trade, are fully bearing out the predictions I made of better trade in my latest reports. I am assured, on good authority, that the pig iron trade, as the season gets advanced, will give abundant signs of activity. Inquiries are coming to hand in much greater number than was the case a month ago. This is owing to the greater demand from America, and it is evident that large deliveries will be required for that quarter. Continental and home consumers are using much more liberally. From reliable information I know some very fair contracts have been booked, still makers are backward in doing business to any great extent, on account of lowness in prices. Should the present demand be maintained for any length of time, and there is no reason to doubt otherwise, an advance of quotations will come. In fact, I know of one or two cases where higher prices are already being demanded. Producers being well sold forward are in a position to ask higher values, and higher values must come very soon. Present quotations are 60s. to 65s. per ton. The furnaces are keeping up their heavy output. Second-hand parcels are being gradually wiped out, latterly pretty quickly. There is nothing of any moment taking place in the steel department; they are busily employed on fair orders, and some good contracts are on the books. Iron shipbuilders still very actively engaged, and hold plenty of work to keep them active for a considerable time. Other industries fairly employed. Iron ore in good request.

## THE SHEFFIELD DISTRICT.

*(From our own Correspondent.)*

Dr. Webster, the United States Consul at Sheffield, has again kindly placed at my service the principal figures of his official returns of Sheffield exports to America. The first quarter of the new year closed on March 31st, and the returns were made up last Tuesday. The result came out thus:—

| | Steel. | | | Cutlery. | | | Total. | | |
|---|---|---|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| January .. .. | 18,781 | 4 | 10 | 21,252 | 1 | 2 | 51,733 | 2 | 8 |
| February .. | 25,418 | 14 | 4 | 23,740 | 4 | 0 | 92,681 | 7 | 1 |
| March .. .. | 33,459 | 17 | 2 | 18,465 | 1 | 3½ | 136,911 | 15 | 7½ |
| | 77,659 | 16 | 4 | 63,457 | 7 | 5½ | 281,326 | 5 | 4½ |

These figures show an increase of nearly £50,000 over the corresponding quarter of 1880, and of £40,000 over the previous quarter ending December last. During the last three months, however, cutlery has advanced by £7000, while steel has fallen by £12,000. During March the trading with the States was exceptionally brisk, the exports, it will be seen, being nearly £137,000, or about as much as January and February combined. In the totals given above "rails" are included in the articles which swell the values in the third column.

Sheffield trade with America touched its highest point in 1872, when the exports were £1,734,626, and its lowest in 1878, when the values dropped to £429,016. Last year the values again increased to over one million sterling—£1,075,242. If the rate of increase shown by the first quarter of 1880 is maintained, the total in December should not be less than £1,250,000.

There is great activity in the armour-plate trade. Our own Government continues to order very freely, and some orders are dropping in from France and Germany.

Shipbuilding material is in good demand, and the engineering houses, on the whole, are doing a satisfactory business, though there has been a falling off of late in the call for engineers' tools.

Crucible steel continues in request, and Bessemer also maintains the improvement noted last month. Files, edge tools, saws, and similar goods continue very quiet.

The coal trade continues very quiet. Prices are low, and the price-lists for April prove that the coalowners have to make considerable sacrifice to tempt back business which was driven elsewhere by the strike. Hard coal for locomotive purposes is pretty freely supplied as per contract, but other kinds of fuel are very languidly sought after.

In the iron trade, the event of the week is the improvement in Bilbao iron ore shares. These have been very flat for a long time, but the issue of the last report, followed by the successful efforts of the directors to acquire the rights and royalties of the vendors, has inspired fresh confidence in the undertaking, the shares of which have risen from £27 to £32. They are £50, fully paid up. Sir John Brown, of Endcliffe Hall, Sheffield, and the executors of the late Mr. William Fowler, of Sheepbridge Coal and Iron Company, are the vendors. They are to receive £67,000 for their rights.

## NOTES FROM SCOTLAND.

*(From our own Correspondent.)*

The Glasgow iron market has not been so active this week, the advantage gained last week in the prices of warrants not being sustained. No doubt the backward condition of the foreign inquiry is the principal cause of the relapse; but be that as it may, it is apparent that unless an improvement comes without much delay, the hopes that better weather would bring a large accession of orders will be proved to have been based on nothing better than surmise. The shipments in the course of the past week amounted to 10,421 tons as compared with 12,262 in the preceding week, and 15,822 in the corresponding week of last year. As yet the inquiries from the Continent have been few and unimportant, but it is confidently expected that these will become larger during the present month. Iron is being sent into store at the rate of from 3000 to 4000 tons per week. This week's addition to the stock in Messrs. Connal and Co.'s stores, has been 3824 tons, bringing up the aggregate to 541,045 tons. Of course, no account is taken in these figures of the quantities of iron placed in stock at makers' works. There are 121 furnaces in blast, as against 114 at the same date last year.

Business was done in the warrant market on Friday forenoon at from 49s. 10½d. to 49s. 2½d. cash, and 50s. to 49s. 4d. one month, the afternoon quotations being 49s. 3d. to 48s. 10½d. and back to 49s. 2½d. cash, and 49s. 4d. one month. The market was dull on Monday, when a further reduction of prices took place. In the morning business was done at from 49s. 1½d. to 48s. 7½d. cash, and 49s. 2d. to 48s. 9d. one month, the quotations in the afternoon being 48s. 7d. to 48s. 3d. cash, and 48s. 6d. one month. On Tuesday the market was steady, with business at 48s. 3d. to 48s. 7½d. cash, and 48s. 6d. to 48s. 8d. one month. On Wednesday transactions were effected in the forenoon at 48s. 10½d. one month, to 48s. 6½d. cash. To-day—Thursday—being a general holiday, there was no market.

Makers' iron does not show much change in prices this week. G.m.b., f.o.b. at Glasgow, No. 1, is quoted at 49s. 6d., No. 3, 47s.; Gartsherrie, 58s. and 50s. 6d.; Coltness, 58s. 6d. and 50s. 6d.; Summerlee, 57s. 6d. and 49s. 6d.; Langloan, 58s. 9d. and 50s.; Carnbroe, 55s. and 49s. 9d.; Clyde, 49s. 6d. and 47s.; Govan, ditto, ditto; Calder, at Port Dundas, 58s. and 50s.; Glengarnock, at Ardrossan, 55s. and 50s.; Eglinton, 49s. and 47s.; Dalmellington, ditto, ditto; Shotts, at Leith, 59s. and 51s.; Kinneil, at Bo'ness, 50s. and 49s.; and Carron, at Grangemouth, 50s. and 49s.

The marine engineering and ironfoundry trades are still very busy, and have every prospect of good employment throughout the present. Some kinds of malleable iron, on the other hand, are not quite so brisk, and in one or two cases a slight reduction has been made in quotations, notably in bars, which are about 5s. per ton less. Pipe founders have not been doing quite so well of late, and new work is occasionally looked for.

Last week's shipment of iron manufactures from the Clyde embraced £11,282 worth of machinery, of which £9700 went to Manilla and £860 to the Mediterranean; £2588 sewing machines, of which nearly the whole went to Mediterranean ports; £26,000 miscellaneous goods, of which £5900 were dispatched to Rangoon, £5830 to Bombay, £3080 to Singapore, £4500 to Manilla, £1900 to Java, £2200 to the Mediterranean, and £1350 to New York.

The inland trade in coals is large, the continuance of cold weather brings in extra orders from the domestic consumer. Still the supply is now heavy, and prices have again been somewhat reduced. Main coal is put on board in the Clyde at 6s. to 6s. 6d. per ton, splint 7s. to 7s. 3d. Best qualities of household coals are being delivered at the consumers' doors at 11s. to 12s. 6d. per wagon of 24 cwt. The foreign inquiry for coals has not been quite up to expectations, but there is at the same time some little improvement. It was thought that, as the bad weather which prevailed during February and March had retarded shipments, there would be a considerable improvement this month in the export trade. As far as Glasgow is concerned, this has already to some extent been the case, although the great bulk of the trade consists of coasting traffic. The quantity exported last week was about 14,000 tons, 2000 more than in the preceding week, and 4500 more than in the corresponding week of last year. From Ayr 6963 tons were shipped, and 5131 from

Troon, the great proportion being carried coastwise. A fair inland trade continues to be done in the Eastern mining counties, and the inquiry at the ports is improving, though slowly.

The shipbuilding trade of the Clyde continues very busy. During the three months now ended upwards of forty vessels have been launched, with an aggregate tonnage of about 61,000, and there remained 129 vessels on the stocks, a good proportion of which are almost ready for launching. Some good additional orders have recently been placed, and the trade is sure to be active throughout the year.

The shipping trade of the Clyde is likewise active, the inward tonnage for the past month showing an increase of 17,655, and the outward 11,410 over those of March, 1880. During the quarter there is an increase of 46,888 tons in the arrivals, and of 40,661 in the departures.

Messrs. John Elder and Co. have just launched the Elbe, an iron screw steamer of 4500 tons, for the North German Lloyd's Company, of Bremen. She is 440ft. in length, and will accommodate 120 first, 120 second, and 1000 steerage passengers, besides a crew of 170 men.

## THE NORTH OF ENGLAND.

*(From our own Correspondent.)*

The Cleveland iron market has undergone some vicissitudes during the week. On Thursday last the value of g.m.b. foundry pig iron rose from 38s. 3d. to 39s. f.o.t. Middlesbrough. This was as usual in sympathy with a similar movement of the Glasgow market, and when the latter again fell away, the Cleveland market immediately followed suit. On Monday the ironmasters' statistics for March were published. They show that the same number of blast furnaces are in operation as during the previous month, but that one of them has been taken off Cleveland and put on to hematite iron. Nevertheless the make of Cleveland iron averaged as much per day during March as it did during April, whilst the average production of hematite was somewhat increased. The rather favourable shipments of the month had told, as was anticipated, upon the stocks. The shipments amounted to 81,000 tons, and the net increase of stock to 5039 tons. The announcement of those statistics seemed to have a favourable effect upon the tone of the market held at Middlesbrough on Tuesday. It was argued that the Baltic ports are still frozen up, and that therefore trade with them had in no wise assisted to make up the total of last month's shipments. It was said that when they are again open, which, owing to the lateness of the season, will not be before the end of April or beginning of May, a brisk trade with them must ensue. Notwithstanding these hopeful anticipations the market value of pig iron could not be said to be more than 38s. 6d. for prompt, and 39s. for postponed delivery. In manufactured iron prices are steady. Ship plates in large quantities, and favourable specifications command £6 f.o.t. Middlesbrough, cash less 2½ per cent. Small lots are 5s. per ton more. Angles are at the moment relatively dearer than plates, £5 5s. f.o.t. Middlesbrough being the price for favourable specifications. Bars are about the same price. The Imperial Ironworks — late Jackson, Gill, and Co., Limited, in liquidation—were finally closed on Saturday last. When the company stopped payment nearly two years since, a liquidator was appointed, and it was decided that he, with certain assistance from a committee of creditors, should carry on the works for the present, or until they could be sold as a going concern. At that time the accounts showed, it is said, from 10s. to 20s. in the pound. During the two years which have elapsed, it has been found quite impossible to sell the works at any reasonable price, and manufacturing operations have proved so unremunerative that the results, together with some loss by bad debts, will go far to absorb the value of the assets originally in the hands of the creditors. The stoppage will throw about 300 ironworkers out of employment, and these will not at the moment find it very easy to obtain employment.

The North Eastern Railway Company are now pushing forward briskly the alterations and extensions decided on some time since for the Cleveland district. At South Stockton extensive operations are in progress in the way of demolition of houses and clearing of wide areas in preparation for new constructions. A commencement has been made with the railway bridge which is destined to cross the Tees just above the present one. Excavations are proceeding behind the existing station at South Stockton, preparatory to building the new one. Between Stockton and Middlesbrough the line is to be doubled, and cutting and embankment extension is already going on. At Newport the foundations of the new wagon building works, and the sidings in connection are nearly complete, and the superstructure may soon be expected to show itself. The new island station which is to take the place of those at present in use at South Bank and Cargo Fleet, and which is located midway between, is now a scene of great activity. The diversion of the lines has been made, and the station, walls and platforms are beginning to be visible. As abolishing one of the stoppages made by the trains travelling eastward from Middlesbrough, this substitution will be very welcome to the many persons who, living at Redcar and Saltburn, have their offices in the iron metropolis. Altogether the railway company are spending a large amount of money, which will eventually affect favourably the interests of the whole district.

The shipbuilding industry continues very active. The wages' difficulties, which have been adversely affecting it for some time, have mostly been got over as regards the Tyne and the Hartlepools. At Sunderland it is feared there is yet trouble in store. The class of vessels now building are mainly large cargo ships, destined for the live cattle, dead meat and general provision trades. It is becoming more and more apparent that the dense population of our northern counties, with their laborious habits and high wages, form one of the markets for provisions most worth cultivating. It is further evident that this market must be supplied from across the seas; and delivery must be made direct to the ports nearest to the principal centres of population. Already a direct line between New York and West Hartlepool is in successful operation, and another is being established between the former port and the Tyne. In course of time there is little doubt but that similar lines will terminate in all the other principal ports of the north-east coast. The more our northern mining and manufacturing populations learn to live upon foreign food, the quantity of which is practically unlimited, the more will the districts they inhabit be given up to mining and manufacturing operations, and the less will agriculture be considered. Indeed, the more will speculation take place in the direction indicated by the natural qualifications of the people and country. If only the Americans would do the same, and adopt a free-trade policy—which may come some day—the result might be a measure of prosperity to both populations, hitherto unenjoyed by either.

## WALES & ADJOINING COUNTIES.

*(From our own Correspondent.)*

The signs abroad in the coal trade are not encouraging. There is still a flagging character in the market, and colliers, both in the house and steam branches, are exhibiting more restlessness. I fear that if prices are not sustained so as to admit of an advance to the colliers at the next examination of books, we shall have some disquietude in the district. The Welsh colliers have exhibited of late all the primitive characteristics of impulsiveness and lack of judgment, conspicuously shown in refusal to join the Miners' Permanent Fund. There is now also a quiet movement going on to dissever the house colliers and the steam men, and in addition to the Coedcae difficulty, there has been a ferment within the last few days at the Ocean collieries—five in number—respecting the price of dead work. A large meeting, attended by the colliers from the respective pits, has been held, and the resolutions formed there have been submitted to Mr. Jenkins, the manager, whose reply is daily expected. The men of these collieries are not connected with the sliding scale, but have separate arrangements with their employers, and it is these, allowing certain rates for heading, cogging, &c., which they allege have not been carried out.

I see the London market has gone up 6d. per ton during the week, and this may lead to improvement of things in this direction, and help to maintain greater firmness in coal. The output of coal is large and steady. The total exports from all Wales last week were 142,000 tons, of which Cardiff sent 103,000; Newport, Mon., 74,000 tons; and Swansea, 15,000 tons.

There has been an election of members in the working man's section of the Sliding Scale Committee at Mountain Ash, and at this a good deal of dissatisfaction was expressed with one member who had not only spoken strongly in favour of the Miners' Permanent Fund, but had advocated its excellence in the Welsh and English papers. This proved to be fatal to the member's claim for re-election, and he was passed over.

It is currently reported that Mr. McKay has obtained the contract for the new line, the Newport, Pontypridd, and Caerphilly.

I intimated some time ago that the colliery of Abercwmbog was to be abandoned. Notice has now been given to manager and men by present proprietor, but as the lower seams are still somewhat intact, it is not thought likely that the place will be abandoned altogether, other capitalists being prepared to take it.

The east winds are telling seriously on the despatch of vessels from all the Welsh ports, and the same complaint exists at Lydney, where the coal trade is much depressed in consequence.

The iron trade continues in a healthy state. Siemens steel, which holds a high, if not the highest, class, is in demand, and five more open hearths are in course of construction at Swansea. Most of the works are busy, and bar iron has a tendency to advance. This is more than ever discouraging to the tin trade, and it is the common subject of speculation in the district that unless an improvement sets in, as regards this branch, the men of lesser means must go to the wall.

Fully 10,000 tons of iron and steel left the Welsh ports last week. From Newport one large cargo of 2405 tons went to Sydney, I hear that the Government of New South Wales are in the market for 20,000 tons of steel rails—flange—and there is a strong probability of a fair proportion being placed here.

The Government of Victoria are also inviting tenders for rails, and altogether colonial business seems to be looking up.

I have remarked previously on the rapid exhaustion of the famous No. 3 Rhondda seam. The Mynyddyslwn, a fine seam of the bituminous, is going still more rapidly.

Last week the rails were taken out of Powell's Gellygaen pits, where this seam has been quite run out.

The Penarth Harbour Dock and Railway Bill has passed.

New coal workings by Mr. Crawshay are contemplated in the Clydach Valley.

Mr. Clark is announced as on the eve of retiring from Dowlais Works.

Telephonic Exchanges.—We are asked to say that the difficulties which have hitherto prevented the United Telephone Company extending their exchange system over the whole metropolis, owing to the Post-office monopoly, have now been removed, and the Post-office has granted a licence to the company to erect telephone exchanges, they paying the Post-office an annual royalty on the subscriptions received.

The Board of Trade and Steel.—In our impression for March 18th, page 205, in an article on "The Effects of Punching on Steel," &c., it is stated that "it will be remembered that all the plates tested were pulled asunder by Mr. Kirkaldy." We are requested to state that this is not quite correct. Mr. Kirkaldy's name is attached to all the tables or tests which he made at the end of the memorandum. Those to which his name is not attached he had not anything to do with.

## 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 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.

*29th March*, 1881.

76. Combined Knives, W. Ritchie, Edinburgh.
1377. Airing Gussets, &c., W. Sachs, Berlin.
1378. Travelling Trunks, W. Jones, Wolverhampton.
1379. Rolls, H. Haddan.—(*T. S. Cook, Cleveland, U.S.*)
1380. Screens, W. E. Crowther, Manchester.
1381. Boots, I. Kay, Sheffield.
1382. Rotary Engine, L. A. Groth.—(*H. Schönfeldt and C. F. Höhne, Berlin.*)
1383. Thermometers, W. B. Fowle, London.
1384. Lighting, &c., W. Lake.—(*A. Holcombe, U.S.*)
1385. Bobbins, &c., J. Clayton, Bradford.
1386. Fuels, H. Crellin, Richmond, & C. Rolfe, London.
1387. Sifting Cinders, T. Bradford, London.
1388. Engines, J. Ewins & H. Newman, Birmingham.
1389. Caloric Engines, M. P. W. Boulton, Oxford.
1390. Traveller Rings, C. A. Snow.—(*J. Y. Anthony and W. K. Evans, U.S.*)
1391. Incubators, R. J. Ruymp, jun., Norwich.
1392. Arithmometers, S. Tate, London.
1393. Electric Drills, J. H. Thomson, Shoeburyness.
1394. Signalling, J. Park and H. Pryce, London.
1395. Electrical Apparatus, W. R. Lake.—(*A. E. Dolbear, Somerville, U.S.*)
1396. Thrashing Machines, J. Marshall, Gainsborough.

*30th March*, 1881.

1397. Field Rollers, R. Maynard, jun., Whittlesford.
1398. Pumps, G. W. von Nawrocki.—(*C. Blasendorff, Berlin.*)
1399. Coating Apparatus, I. Matthews, Abercarne.
1400. Biscuits, F. Engel.—(*W. Gaedke, Hamburg.*)
1401. Pianos, H. J. Haddan.—(*J. Bennert, Cologne.*)
1402. Stands, &c., J. Kettle, London.
1403. Substitute for Coffee, J. Anderson, Glasgow.
1404. Governors, W. H. and J. Sutcliffe, Todmorden.
1405. Springs, D. Blackadder, Sheffield.
1406. Coating Metal, J. Lysaght, Bristol.
1407. Permanent Way, C. Bergeron, London.
1408. Fire-arms, J. J. Atkinson, London.

*31st March*, 1881.

1409. Engines, J. E. A. Gwynne and W. Ellis, London.
1410. Washing, G. Collier, Newcastle-on-Tyne.
1411. Hydraulic Apparatus, E. de Pass.—(*P. O. Oechelhäuser, Berlin.*)
1412. Carbons, J. Scott and W. Akester, Newcastle-upon-Tyne.
1413. Sewage Works, W. H. Denham, Southsea.
1414. Pipes, J. S. Rigby, Farnworth, and J. Mangnall, Manchester.
1415. Hats, H. J. Haddan.—(*Dr. Nietzsche, Plauen.*)
1416. Indicators, A. Budenberg.—(*C. F. Budenbery and B. A. Schaeffer, Buckau-Magdeburg.*)
1417. Weighing, M. D. Pass, East Greenwich.
1418. Weaving, &c., W. Strang, Glasgow.
1419. Pen-holders, T. A. Hearson, Greenwich.
1420. Glazing, &c., J. Russell, London.
1421. Perforating, C. G. Beddoe, Lambeth-road.
1422. Electric Light, W. Crookes, London.
1423. Feeding Mills, J. H. Carter, London.
1424. Acetate of Soda, W. G. Forster, London.
1425. Screws, &c., J. Mackintire, London.
1426. Harvesting Machine, J. Hornsby, J. Innocent, and G. T. Rutter, Grantham.
1427. Measuring, J. Imray.—(*J. Canale, Paris.*)
1428. Colouring Matters, C. D. Abel.—(*H. Koechlin, Lerrach, and O. Witt, Mulhouse.*)
1429. Sanitary Receptacles, J. Turner and J. Robertshaw, Manchester.

*1st April*, 1881.

1430. Railway Brakes, E. W. Furrell, London.
1431. Knitting Machinery, W. Morgan-Brown.—(*H. Schwerer, Werdova.*)
1432. Deodorising Bed-pans, &c., W. Morgans, Bristol.
1433. Keyless Watches, C. H. Errington, Coventry.
1434. Disinfectant Apparatus, H. Barron, London.
1435. Enclosing Materials, W. Schönheyder, London.
1436. Photography, L. Warnerke, Champion Hill.
1437. Knives, &c., W. H. Stokes, Birmingham.
1438. Locks, H. Lunt.—(*L. Lunt, New York, U.S.*)
1439. Valves, W. Westwood and E. Wright, Dudley.
1440. Preventing Explosions, B. Giles, Blackheath.
1441. Furnaces, W. Dutton and M. Croft, Walsall.
1442. Electric Batteries, F. R. de Wolski, Gosport.
1443. Cleaning Grain, L. Gathmann, Chicago, U.S.
1444. Millstones, W. R. Lake.—(*E. Streitz, Germany.*)
1445. Hair Felt, J. Erskine, Greenock.
1446. Venetian Blinds, T. Kauffmann, Cologne.
1447. Dynamo-electric Machines, C. W. Siemens.—(*Messrs. Siemens and Halske, Berlin.*)
1448. Regenerating, W. R. Lake.—(*Société Coignet, père et fils, et Compagnie, Paris.*)

*2nd April*, 1881.

1449. Fire-grates, &c., A. MacPhail, London.
1450. Alarm Apparatus, R. McDonald, Wishaw.
1451. Liquefiable Gas, J. Mewburn.—(*J. Gamgee, U.S.*)
1452. Tills, &c., T. E. Boyce, London.
1453. Interlocking Apparatus, C. Hodgson, London.
1454. Dyeing, &c., W. and H. W. Brown, Selkirk.
1455. Looms, &c., J. Wood, Bingley.
1456. Fire Extinguisher, W. H. Beck.—(*L. C. Blon and J. Kratzenstein, Paris.*)
1457. Ventilating, R. H. Reeves, Parkhurst.
1458. Feeding Apparatus, P. Justice.—(*Sedgwick and Stuart Manufacturing Company (Incorporated), U.S.*)
1459. Ball-cocks, &c., W. Baird, Dublin.
1460. Rakes, &c., G. E. Vaughan.—(*The Johnson Harvester Company, Brockport, U.S.*)
1461. Alimentary Products, A. M. Clark.—(*R. Bravais, Paris.*)

*4th April*, 1881.

1462. Arranging Types, F. Wicks, Glasgow.
1463. Raising Vessels, R. Hodgson, London.
1464. Preserving, H. A. Bonneville.—(*A. Robert, Paris.*)
1465. Spinning, &c., Cotton, G. Bodden, Oldham.
1466. Lighting Apparatus, J. Sainty, Wisbech.
1467. Registering Apparatus, S. C. Straker, London.
1468. Colouring Beer, A. B. Worthington, Beccles.
1469. Mining Machine, H. H. Doubleday.—(*F. M. Lechner, Waynesbury, U.S.*)
1470. Sugar, A. M. Clark.—(*J. Closson, Paris.*)

### Inventions Protected for Six Months on deposit of Complete Specifications.

1379. Rolls, H. J. Haddan, Strand, London.—Com. from T. S. Cook, Cleveland, U.S.—29*th March*, 1881.
1390. Traveller Rings, C. A. Snow, Washington.—Com. from J. Y. Anthony, Taunton, and W. K. Evans, Berkley, U.S.—29*th March*, 1881.
1395. Electrical Apparatus, W. R. Lake, Southampton-buildings, London.—Com. from A. E. Dolbear, Somerville, U.S.—29*th March*, 1881.
1401. String Attachments, H. J. Haddan, Strand, London.—Com. from J. Bennert, Cologne.—30*th March*, 1881.
1429. Sanitary Receptacles, J. Turner and J. Robertshaw, London.—31*st March*, 1881.

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

1253. Metallic Brushes, G., R., and E. Ashworth, Manchester.—30*th March*, 1878.
1271. Combing Cotton, G. Freemantle and J. Dugdill, Moston, Manchester.—30*th March*, 1878.
1272. Revolving Fire-arms, A. M. Clark, Chancery-lane, London.—30*th March*, 1878.
1281. Calcining Iron, &c., C. Leech and T. Neal, Derby.—1*st April*, 1878.
1305. Hydraulic Capstans, A. B. Brown, Rosebank Ironworks, Edinburgh.—3*rd April*, 1878.
1715. Colouring Matters, F. Wirth, Frankfort-on-the-Main.—29*th April*, 1878.
1269. Looms for Weaving, H. Portway, Bradford.—30*th March*, 1878.
1278. Steam Engine Indicators, J. W. Kenyon, Manchester.—1*st April*, 1878.
1318. Incubating Apparatus, M. Arnold, Acton, London.—3*rd April*, 1878.
1343. Carding Flocks, &c., S. and C. Gauntlet, Trowbridge.—4*th April*, 1878.
1385. Coverings, C. Toope, Chancery-lane, London.—6*th April*, 1878.
1440. Making Sand Moulds, W. R. Lake, Southampton-buildings, London.—10*th April*, 1878.
1441. Ordnance, A. Longsdon, Queen Victoria-street, London.—11*th April*, 1878.
1514. Working Guns, &c., A. Longsdon, Queen Victoria-street, London.—16*th April*, 1878.
1300. Steering Ships, S. W. Snowden, Waverley-terrace, Kenilworth, Dublin.—2*nd April*, 1878.
1304. Neck, &c., Chains, J. E. Orry, Paris.—2*nd April*, 1878.
1448. Photographic Camera, S. W. Rouch, Strand, London.—11*th April*, 1878.
1303. Torpedo Boats, &c., W. R. Lake, Southampton-buildings, London.—2*nd April*, 1878.
1332. Bolts, B. Ramsden, Leeds.—4*th April*, 1878.
1346. Lawn Mowing Machines, W. R. Lake, Southampton-buildings, London.—4*th April*, 1878.

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

1104. Peat, &c., J. Imray, Southampton-buildings, London.—30*th March*, 1874.
1085. Kitchen Ranges, &c., J. Wood, Bradford.—28*th March*, 1874.
1119. Potters' Clay, W. Boulton, Providence Foundry, Burslem.—31*st March*, 1874.
1122. Furnace Bars, J. Dodge, Garden-row, and T. E. Coles, Earl-street, London.—31*st March*, 1874.
1190. Tawing, &c., Skins, W. E. Gedge, Wellington street, Strand, London.—4*th April*, 1874.
1175. Water-closets, &c., E. Pearson, Old Kent-road, London.—4*th April*, 1874.

### Notices of Intention to Proceed with Applications.

*Last day for filing opposition, 22nd April*, 1881.

4861. Filtering Water, C. G. Pfander, Queen Victoria-street, London.—23*rd November*, 1880.
4021. Lubricating Shafting, T. Monk and J. Anderton, Blackburn.—26*th November*, 1880.
4922. Producing Copies of Drawings, &c., E. Edwards, London.—Com. from M. Tilhet.—26*th November*, 1880.
4929. Knife-cleaning Machines, T. S. Lyon, Percival-street, London.—26*th November*, 1880.
4930. Pliers, &c., W. M. Cranston, London.—A com. from J. F. Cranston.—26*th November*, 1880.
4951. Music Seats, H. B. Fox, Oxton—27*th November*, 1880.
4953. Raised Letters, J. and A. Duckett, Burnley.—29*th November*, 1880.
4954. Facing, &c., Billiard Cues, C. F. Hengst, Forest-gate, Essex.—29*th November*, 1880.
4956. Spinning, &c., Fibrous Substances, B. Brown, Bury.—29*th November*, 1880.
4962. Chests, W. T. Eades, Birmingham.—29*th November*, 1880.
4965. Counter-stays, &c., H. H. Lake, London.—A com. from S. L. Bailey.—29*th November*, 1880.
4966. Colouring Matter, F. Wirth, Germany.—A com. from E. Oehler.—29*th November*, 1880.
4971. Pliers, J. T. Neighbour, Lismore-road, London.—29*th November*, 1880.
4974. Pumping, &c., Engines, T. and G. Wilson, Glasgow.—30*th November*, 1880.
4983. Lamps, G. Day, Birmingham.—30*th November*, 1880.
4996. Cocks and Taps, J. Walker, London.—1*st December*, 1880.
5021. Actuating Mechanism of Manglbs, T. Bradford, London.—2*nd December*, 1880.
5051. Time-pieces, W. P. Thompson, London.—A com. from M. A. Lemoine.—4*th December*, 1880.
5094. Preparing Vegetable Fibres, P. Justice, London.—A com. from J. Stephens.—7*th December*, 1880.
5146. Obtaining Products from Sulphuric Acid, W. Weldon, Rede-hill, Burstow.—29*th December*, 1880.
5147. Lamps, T. Rolfe, Birmingham.—9*th December*, 1880.
5155. Meters, S. Toy, Birmingham.—10*th December*, 1880.
5179. Spinning, T. Coulthard, Preston, and J. M. Hetherington, Manchester.—10*th December*, 1880.
5268. Transmitting Drawings, &c., A. Reddie, London.—A com. from J. André.—15*th December*, 1880.
5276. Windlasses, G. D. Davis, Commercial-road, Stepney.—16*th December*, 1880.
5347. Engines, S. Robinson, Westbromwich.—21*st December*, 1880.
5362. Regulating the Supply of Steam, J. Churchill, Langden-road, London.—21*st December*, 1880.
210. Beds, &c., G. Lowry, Salford.—15*th January*, 1881.
610. Paving, &c., P. Stuart, Edinburgh.—12*th February*, 1881.
644. Heating, &c., G. E. Pritchett, Bishop's Stortford.—15*th February*, 1881.
661. Sheep Racks, &c., Combined, E. Thomas, Oswestry.—16*th February*, 1881.
687. Dressing Flour Middlings, T. F. Hind and R. Lund.—17*th February*, 1881.
733. Gauges, W. R. Oswald, Gracechurch-street, London.—21*st February*, 1881.
768. Connecting Carbon Ends in Electric Lamps, E. G. Brewer, London.—A com. from T. A. Edison.—23*rd February*, 1881.
778. Valves, E. O. Mundy, Preston-road, Stratford.—24*th February*, 1881.
792. Electric Lamps, P. Jensen, London.—A com. from T. A. Edison.—24*th February*, 1881.
833. Steam Pumps, J. Shanks and J. G. Lyon, Arbroath.—26*th February*, 1881.
854. Extinguishing Fire, C. Tuchmann, Surrey.—A com. from J. Schambeck.—28*th February*, 1881.
964. Chlorine, W. Weldon, Rede-hall, Burstow.—7*th March*, 1881.
965. Chlorine, W. Weldon, Rede-hall, Burstow.—7*th March*, 1881.
966. Chlorine, W. Weldon, Rede-hall, Burstow.—7*th March*, 1881.
967. Hydrochloric Acid and Chloride, W. Weldon, Rede-hall, Burstow.—7*th March*, 1881.
968. Chlorine, W. Weldon, Rede-hall, Burstow.—7*th March*, 1881.
995. Artificial Fuel, G. Walters, Wadbury, Frome, and W. Morgans, Bristol.—8*th March*, 1881.
1007. Boot Protectors, J. Fieldhouse, Keighley.—9*th March*, 1881.
1016. Verber-meters, E. G. Brewer, London.—A com. from T. A. Edison.—9*th March*, 1881.
1017. Furnaces, A. M. Clark, London.—A com. from M. J. L. Marie.—9*th March*, 1881.
1020. Sewing Machines, J. B. Robertson, Lurgan.—9*th March*, 1881.
1045. Arranging Flues, G. Love, jun., Malton House, Lanchester.—11*th March*, 1881.
1053. Lozenges, J. Rough and J. Hurry, Dalkeith.—11*th March*, 1881.
1060. Tubular Boilers and Furnaces, R. and F. Garrett, Leiston.—11*th March*, 1881.
1062. Steering Apparatus, W. R. Cooper and J. Taylor, Sunderland.—11*th March*, 1881.

1089. MOTORS, D. Clerk, Glasgow.—14*th March*, 1881.
1094. AUTOMATIC RAPID TELEGRAPHY, B. Mills, London.—A com. from C. A. Leggo.—14*th March*, 1881.
1161. PURIFYING [illegible] ALKALINE SOLUTIONS, E. Carey, H. Gaskell [illegible] P. Hurter, Widnes.—17*th March*, 1881.
1179. HELICAL [illegible] L. Sterne, Victoria-chambers, Westminster.—18*th March*, 1881.
1379. ROLLS, H. J. Haddan, Strand, Westminster.—A com. from S. Cook.—29*th March*, 1881.

*Last day for filing opposition, 27th April*, 1881.

1975. WASHING MACHINES, J. Mitchell, Newcastle-on-Tyne.—A com. from J. Storey.—30*th November*, 1880.
4981. TELEPHONIC APPARATUS, W. R. Lake, London.—A com. from C. A. Randall.—30*th November*, 1880.
4986. REGULATING the FLOW of LIQUIDS, W. Morris, F. P. Preston, J. Prestige, and E. Preston, Deptford.—30*th November*, 1880.
4990. OPENING, &c. CASEMENTS, J. Bruce, Birmingham.—30*th November*, 1880.
4998. PURIFYING GAS, W. J. B. Symes, Oxford-street, Stepney, London.—1*st December*, 1880.
5003. MIXING, &c., SUBSTANCES, P. Pfleiderer, Farringdon-street, London.—1*st December*, 1880.
5018. REFINING, &c., PULP, G. Tidcombe, sen., and G. Tidcombe, jun., Watford.—2*nd December*, 1880.
5025. CLEANING FLUES of STEAM BOILERS, R. Sutcliffe, Castle Mills, Idle.—2*nd December*, 1880.
5026. SPIRIT LEVELS, R. Sutcliffe, Castle Mills, Idle.—2*nd December*, 1880.
5027. SAFES, R. Sutcliffe, Idle.—2*nd December*, 1880.
5035. GRAIN-BRUISING, &c., MACHINE, F. T. Turner, Kenninghall.—3*rd December*, 1880.
5036. PREVENTING INCRUSTATION in BOILERS, A. Jay, Kingswood-hill, near Bristol.—3*rd December*, 1880.
5038. TAPS, &c., J. L. Corbett, Glasgow.—3*rd December*, 1880.
5042. WEAVING FABRICS, G. Hargreaves and T. Bracewell, Shipley.—3*rd December*, 1880.
5043. METALLIC FURNITURE, A. and R. F. Heath, Birmingham.—3*rd December*, 1880.
5056. VARICOSE VEINS, &c., J. R. A. Douglas, Hounslow, London.—4*th December*, 1880.
5063. BOTTLING AERATED LIQUIDS, F. Foster and S. Barnett, sen., London.—4*th December*, 1880.
5079. CALIPERS, A. Scott, London.—6*th December*, 1880.
5089. RETAINING ARTIFICIAL TEETH, C. G. Whiting, Coventry.—7*th December*, 1880.
5100. REGULATING the PRESSURE, &c., of GAS, H. Barlow, New York.—7*th December*, 1880.
5121. GAS BURNERS, C. Defries, London.—8*th December*, 1880.
5125. PRODUCING MARKS on PAPER, A. Ford, London.—8*th December*, 1880.
5140. BOXES, &c., F. Colas, Paris.—9*th December*, 1880.
5158. MOULDS, J. T. King, Liverpool.—A com. from S. J. Adams.—10*th December*, 1880.
5191. TREATING FATS and OILS, C. A. Burghardt, Manchester.—11*th December*, 1880.
5215. SEWERS, &c., W. Edes, Dover.—13*th December*, 1880.
5219. GAS MOTOR ENGINES, A. Fiddes, Bristol.—13*th December*, 1880.
5246. DISCHARGING, &c., CARGOES, H. Adams, London.—14*th December*, 1880.
5267. FASTENINGS for NECKTIES, E. de Pass, London.—A com. from S. Hayem.—15*th December*, 1880.
502. WATER-PROOF GARMENTS, J. T. Goudie, Glasgow.—5*th February*, 1881.
655. ARMOURED VESSELS, &c., J. H. Johnson, London.—A com. from N. B. Clark.—15*th February*, 1881.
847. TREATING QUARTZ, &c., W. E. Gedge, London.—A com. from L. Thénot.—28*th February*, 1881.
933. CUTTING LETTERS, &c., on WOOD, F. W. Ventris, Manchester—4*th March*, 1881.
950. INDICATORS for BEER ENGINES, F. J. Hoster, Manchester.—5*th March*, 1881.
954. PAVING BLOCKS for ROADWAYS, J. Taylor, Albert-square, Clapham-road, Surrey.—5*th March*, 1881.
1074. GAS ENGINES, E. Bénier and A. Lamart, France.—12*th March*, 1881.
1119. TELEGRAPHY, S. Pitt, Sutton.—A com. from O. Lugo.—15*th March*, 1881.
1125. BOTTLES, H. Codd, King William-street, London.—15*th March*, 1881.
1129. FURNACES, W. P. Thompson, London.—A com. from O. D. Orvis.—16*th March*, 1881.
1134. LAMPS, J. Fyfe, Glasgow.—16*th March*, 1881.
1152. OPENING BOTTLES, H. Codd, King William-street, London.—16*th March*, 1881.
1167. MARINE GOVERNORS, J. B. Scarlett, Oxford.—17*th March*, 1881.
1173. ASSORTING PULVERISED MATERIALS, A. Reddie, London.—A com. from W. Kracht.—17*th March*, 1881.
1401. STRING ATTACHMENTS for PIANOS, H. Haddan, London.—A com. from J. Bennert.—30*th March*, 1881.

## Patents Sealed

*List of Letters Patent which passed the Great Seal on the 1st April*, 1881.)

3994. GASSING YARNS, W. T. Stubbs and J. Corrigan, Manchester.—2*nd October*, 1880.
4020. WOOL COMBING MACHINERY, J. Heaton, Bradford.—4*th October*, 1880.
4032. FIRE ESCAPES, W. Spence, Quality-court, Chancery-lane, London.—5*th October*, 1880.
4033. DISCHARGING APPARATUS, J. J. and T. L. Galloway, Glasgow.—5*th October*, 1880.
4038. CORD, W. Morgan-Brown, Southampton-buildings, London.—5*th October*, 1880.
4060. WAGONS, P. B. Elwell, Wolverhampton.—6*th October*, 1880.
4072. PRESERVING BACON, &c., J. P. Geary, Tudor-road, South Hackney, London.—7*th October*, 1880.
4075. MOTOR ENGINES, S. Clayton, Bradford.—7*th October*, 1880.
4096. GRATE BARS, J. Dean, Waterloo Mills, Bradford.—8*th October*, 1880.
4098. FURNACES, G. A. Dick, Cannon-street, London.—9*th October*, 1880.
4100. VALVES, J. Woodward, Union-street, Ancoats.—9*th October*, 1880.
4107. FABRICS, &c., J. C. Mewburn, Fleet-street, London.—9*th October*, 1880.
4109. ORDNANCE, A. Noble, Jesmonddine House, Newcastle-upon-Tyne.—9*th October*, 1880.
4135. BREECH-LOADING ORDNANCE, W. Morgan-Brown, Southampton-buildings, London.—12*th October*, 1880.
4137. SEWING MACHINES, G. Illston, Birmingham.—12*th October*, 1880.
4154. PRINTERS' QUOINS, H. J. Haddan, Strand, London.—13*th October*, 1880.
4155. STEAM GENERATOR, H. J. Haddan, Strand, London.—13*th October*, 1880.
4173. FIRE LIGHTERS, J. F. Wiles, Finch-lane, London.—13*th October*, 1880.
4177. FIRE GRATES, E. Taylor, Blackburn.—14*th October*, 1880.
4197. FILLING BOTTLES, A. A. Mondollot, Paris.—15*th October*, 1880.
4200. EXPLOSIVE COMPOUNDS, P. M. Justice, Southampton-buildings, London.—15*th October*, 1880.
4203. LININGS, H. C. Bull, Liverpool.—15*th October*, 1880.
4231. SWEEPING, H. A. Bonneville, Cannon-street, London.—18*th October*, 1880.
4253. MOUNTING EMERY, &c., R. Luke, Lime Bank-street, Ardwick.—19*th October*, 1880.
4278. COKE, &c., H. C. Bull, Water-street, Liverpool.—20*th October*, 1880.
4334. SACCHARINE SUBSTANCES, S. H. Johnson, Stratford.—23*rd October*, 1880.
4348. EXCLUDING AIR, &c., F. Baxter, Burton-on-Trent.—25*th October*, 1880.
4387. FASTENINGS, J. Hinks, T. Hooper and F. R. Baker, Birmingham.—27*th October*, 1880.
4565. LIFE RAFTS, T. Cornish, London-street, Fenchurch-street, London.—6*th November*, 1880.
4767. TRICYCLES, &c., H. Weatherill, Beech-street, Cheetham.—19*th November*, 1880.
4792. FURNACES, W. L. Wise, Whitehall-place, London.—19*th November*, 1880.
4999. GROOVED PULLEYS, &c., J. V. Hope, Wednesbury.—1*st December*, 1880.
5232. TUBE FASTENINGS, E. H. Bennett, Bayonne, U.S.—14*th December*, 1880.
5258. CARDING ENGINES, G. and J. Aimers, Galashiels, and D. Wright, Selkirk.—15*th December*, 1880.
5346. WARMING, &c., ROOMS, J. Smith, Liverpool.—21*st December*, 1880.
5432. TRICYCLES, J. Harrington, Norman's-buildings, Old-street, London.—24*th December*, 1880.
202. FOG SIGNALS, H. A. Bonneville, London.—15*th January*, 1881.
275. ELECTRIC SEMAPHORES, W. R. Lake, London.—21*st January*, 1881.
344. TREATING GRAIN, &c., A. W. Gillman and S. Spencer, Southwark.—26*th January*, 1881.
363. BOILERS, W. Lord, Bury.—27*th January*, 1881.
457. FURNACES, B. J. B. Mills, London.—3*rd February*, 1881.

(*List of Letters Patent which passed the Great Seal on the 5th April*, 1881.)

3960. FIRE ESCAPES, G. Tiviotdale, Cheny-street, Birmingham.—30*th September*, 1880.
3983. ADJUSTING, &c., FURNITURE, J. Horton, Copley.—1*st October*, 1880.
4067. CLOSETS, &c., J. R. Pickard, Leeds.—6*th October*, 1880.
4070. TIE and CORE METAL, G. M. Edwards, London.—7*th October*, 1880.
4073. CARRIAGE DOOR FASTENINGS, W. H. St. Aubin, Willenhall.—7*th October*, 1880.
4077. EYELETTING MACHINES, J. Boothroyd, Leeds.—7*th October*, 1880.
4078. LOOMS, G. P. Hartley, jun., Blackburn.—7*th October*, 1880.
4079. DYEING APPARATUS, J. Lepine and P. H. Roelants, Brussels.—7*th October*, 1880.
4085. ANCHORS, J. Evans, Cradley Heath.—8*th October*, 1880.
4088. TRICYCLES, R. H. Charsley, Oxford.—8*th October*, 1880.
4090. CABS, T. Greenhill, London.—8*th October*, 1880.
4094. EXTRACTING METALS from their ORES, &c., W. Elmore, Blackfriars-road, Surrey.—8*th October*, 1880.
4099. RAILWAY POINTS, H. Whitehead, Bucknall, R. Hodgson and T. Dodd, Winsford.—9*th October*, 1880.
4103. COTTON DRYING FELTS, J. Crossley, Bury.—9*th October*, 1880.
4104. LABELS, W. R. Harris and J. G. Cooper, Manchester.—9*th October*, 1880.
4105. TREATING SOLID MATTERS SUSPENDED in WATER, &c., J. Bannehr, London.—9*th October*, 1880.
4114. CRABBING, &c., FABRICS, G. W. Hawksley, Sheffield, and W. Lumb, Wakefield.—9*th October*, 1880.
4175. BOLT-MAKING MACHINES, S. Gallie, Birkenhead.—14*th October*, 1880.
4179. WASHING ROOTS, W. Griffiths, Shrewsbury.—14*th October*, 1880.
4191. ELECTRIC LAMPS, G. P. Harding, Jermyn-street, Piccadilly, London.—15*th October*, 1880.
4249. GLAZING, &c., PAPERS ROLLED ROUND BOBBINS, A. J. Deblon, Lille.—19*th October*, 1880.
4273. BORING TOOL, W. Timms, West Hartlepool.—20*th October*, 1880.
4303. CONVERTING NITROGENOUS ORGANIC SUBSTANCES into SOLUBLE PRINCIPLES, T. Morgan, Cockspur-street, London.—21*st October*, 1880.
4365. DOMESTIC BATHS, W. T. Sugg, Vincent-street, London.—26*th October*, 1880.
4604. SEWERS, &c., G. E. Waring, jun., Newport.—9*th November*, 1880.
4750. MOULDING MACHINERY, H. T. Grainger, New Church-road, Camberwell.—18*th November*, 1880.
5266. WITHDRAWING, &c., AIR, W. and B. Verity, Stanhope-street, Euston-road, London.—15*th December*, 1880.
5318. HEEL PARING MACHINES, F. Cutlau, Cardiff.—18*th December*, 1880.
5389. EXTRACTING JUICES, &c., A. M. Clark, Chancery-lane, London.—22*nd December*, 1880.
41. KNITTING MACHINERY, J. and H. Kiddier, Nottingham.—4*th January*, 1881.
387. FIRE-GRATES, &c., J. Britton, Stamford.—28*th January*, 1881.
389. INDIA-RUBBER HOSE, J. Burbridge, R. C. Thorpe, and T. Oakley, Tottenham.—28*th January*, 1881.
419. ROVING, &c., FRAMES, G. W. von Nawrocki, Leipziger-strasse, Berlin.—1*st February*, 1881.
431. MOULDING APPARATUS, W. R. Lake, Southampton-buildings, London.—1*st February*, 1881.

## List of Specifications published during the week ending April 2nd 1881.

3136, 6d.; 3148, 1s. 4d.; 3182, 8d.; 3281, 6d.; 3305, 8d.; 3347, 6d.; 3350, 8d.; 3363, 6d.; 3367, 6d.; 3385, 6d.; 3391, 6d.; 3392, 6d.; 3398, 6d.; 3399, 6d.; 3410, 6d.; 3411, 1s. 2d.; 3448, 4d.; 3457, 6d.; 3484, 2d.; 3487, 2d.; 3488, 2d.; 3490, 2d.; 3493, 2d.; 3495, 2d.; 3496, 2d.; 3497, 4d.; 3501, 4d.; 3509, 2d.; 3511, 4d.; 3518, 2d.; 3524, 6d.; 3525, 2d.; 3526, 6d.; 3527, 2d.; 3528, 2d.; 3529, 2d.; 3534, 4d.; 3535, 2d.; 3536, 2d.; 3540, 2d.; 3543, 2d.; 3545, 2d.; 3546, 4d.; 3549, 2d.; 3550, 4d.; 3522, 2d.; 3553, 2d.; 3554, 2d.; 3556, 6d.; 3557, 2d.; 3558, 2d.; 3561, 2d.; 3562, 2d.; 3565, 2d.; 3568, 6d.; 3569, 2d.; 3571, 2d.; 3572, 6d.; 3573, 4d.; 3577, 8d.; 3579, 2d.; 3581, 2d.; 3582, 2d.; 3583, 2d.; 3584, 4d.; 3585, 2d.; 3586, 2d.; 3587, 2d.; 3590, 2d.; 3592, 4d.; 3593, 4d.; 3594, 2d.; 3596, 2d.; 3599, 2d.; 3601, 2d.; 3608, 4d.; 3613, 2d.; 3695, 4d.; 5336, 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.

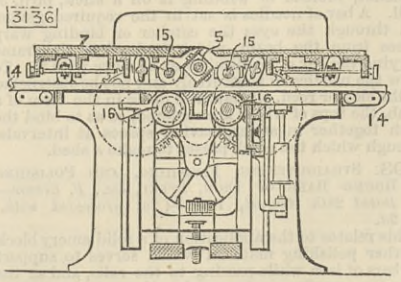
# ABSTRACTS OF SPECIFICATIONS.

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

**3136.** MACHINERY FOR CUTTING WOOD, *A. C. Kirk and D. Thomson.—Dated 30th July*, 1880. 6*d.*

At one end of the framing a vertical spindle is provided for operating by means of a cutter head on the longitudinal edge of a board passing through the machine. A small further addition renders the machine capable of checking boards; and for tenoning, two cutter heads may be arranged at the side of the machine to operate simultaneously on the upper and under sides of the board: and one of these cutter heads may be on the main cutter block or shaft, the

3136

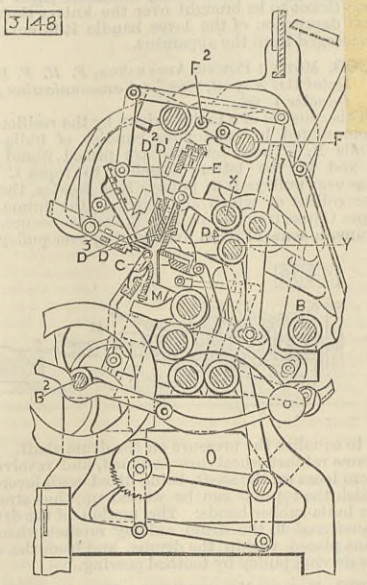



other being on a separate shaft. Across the upper part of the framing there is carried a rotating horizontal shaft or block 5 fitted in the usual way, for the attachment to it of cutters for acting on the wood, and having fast on it a pulley for a driving belt. When the underside of a board is being operated on the depth of action or cut is determined by the positions of horizontal guide plates or tables before and behind the cutter block 5. In the drawing a board 14 is represented as being passed through the machine beneath the cutter 5, for the purpose of being dressed on its upper side. 15, 16 are two pairs of feeding rollers.

**3148.** KNITTING MACHINES, *C. Cresswell.—Dated 31st July*, 1880. 1*s.* 4*d.*

A cam shaft B carries a toothed wheel gearing with a wheel on the hand shaft $B^2$. The needle bar C carries the frame needles secured in tricks by clamping plates, and is hinged to links fitted on a spindle bar provided with truck levers operated by cams. Above it is a presser bar D, the lower edge of which presses the frame needles and the back edge the machine needles. The upper end of D is hinged to links secured on a spindle bar X having truck levers operated by cams, and its lower end to links connecting it to two arms secured on another spindle bar provided with a truck lever operated by a cam, the several cams giving to-and-fro and up-and-down movements to the presser bar, the front of which forms tricks in which the sinkers slide up and down. Each sinker projects at its upper front edge and slides in tricks in a bar $D^1$ secured on the presser bar. In front of the lower end of the sinkers is a bar $D^2$ which acts as a stop and keeps the sinkers in position, such bar with the presser bar forming a sley in which a bar $D^3$ rises and falls. The bar $D^3$ rests on adjustable screws in levers $D^4$ secured on a spindle Y provided with truck

3148



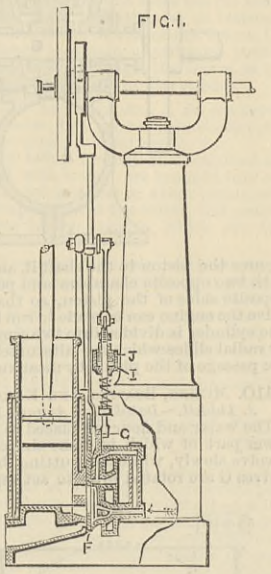

levers operated by cams. The sinkers are lowered by inclines E one to each division, each carried in a box sliding on a bar above the presser bar, each incline being vertically adjustable by a star screw and spring. Above the incline star screw is a spindle bar F, on which are cam bosses, one to each star. The spindle bar carries a lever at each end, studs on which engage with the slotted ends of levers secured on a bar $F^2$ having a notched cam boss on which a gauge screw rests, such screw being carried by a rocking lever, the lower end of which lies under the falling bar. Behind the lower end of the sinkers is a bar with tricks on its front to receive knocking-over bits held to the bar by plates and screws. In front of the plates is a slide M for knocking over the loops on the machine needles. Below the cam shaft is a rocking spindle having a truck lever operated by cams. The spindle carries a frame O and work roller for each breadth of fabric, each roller being larger at the ends than at the centre, and continually holds the selvages down the whole length of the hose.

**3182.** GAS MOTOR ENGINES, *F. W. Turner.—Dated 3rd August*, 1880. 8*d.*

This relates partly to improvements on patent No.

3182

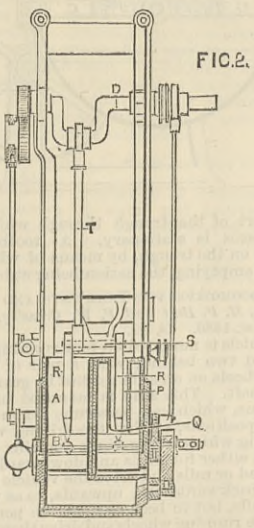
FIG. 1.




1270, dated 29th March, 1879. Fig. 1 is a side elevation of one form of the gas engine showing the cylinder and valves in vertical section. The engine is provided

3182

FIG. 2.

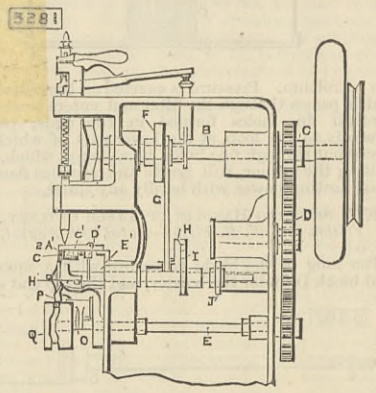



with two slide valves, one to regulate the entrance of gas and air to the cylinder and the ignition of the same, the other to exhaust the foul gases from the cylinder. F is the exhaust slide valve; G the admission and ignition slide valve. I is an air cylinder provided with a piston J for arresting and regulating the motion of the slide valve G. Fig. 2 shows another improvement, wherein it is necessary to use a pump to compress the explosive charge in the cylinder. The cylinder A and the compressing pump P are placed side by side, and the piston B of the cylinder and one plunger Q of the pump are connected by ball joints to piston rods R, which are coupled together by a cross pin working in the end of a rocking plate or beam S, from which pin a connecting rod T extends to the crank shaft D.

**3281.** SEWING MACHINES, *F. Cutlan.—Dated 11th August*, 1880. 6*d.*

This consists in applying to any suitable sewing machine attachments, whereby it is enabled in the case of boot manufacture, to welt, and also stitch the sole to the welt, the arrangement being applicable, however, to purposes other than boot stitching. Motion is conveyed by the toothed wheel C to the intermediate toothed wheel D, which gears into the toothed wheel on shaft E, imparting to the said shaft motion in same direction as main shaft B, on which is fitted cam wheel F, which by means of connecting rod G, provided with ratchet pawl H working on ratchet wheel I, turns the shaft J a few degrees as the main shaft B revolves in the feeding direction, thus giving

3281

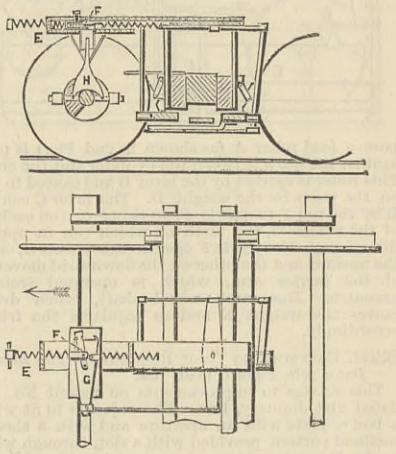



the feed motion required; O support carrying looper P, which is caused to revolve round the needle by means of the double slotted cam Q, attached to the shaft E, and thus the thread passing through the looper P is brought round the needle, and the needle on rising draws or catches the thread on its barb, and pulls it through the leather, thus forming the stitch. I is a guard plate secured to shaft J. Against this guard plate the upper of the boot rests while being operated upon, the welt and sole resting on table H, On shaft J toothed wheel $E^1$ is fixed, gearing into wheel $D^1$ fixed on countershaft $C^1$. The countershaft is fixed to hinge plate $A^1$, said hinge plate being secured to a bracket, also fixed to frame of machine. The course of the feed $C^2$, on countershaft $C^1$, is regulated by screw appliance, and by means of feed $C^2$ the work is carried on in its proper course.

**3305.** RAILWAY BRAKES, *A. M. Clark.—Dated 14th August*, 1880.—(*A communication from J. Van D. Reed.*) 8*d.*

The invention consists in the combination with the longitudinally movable draw-bar of a railroad carriage, of a brake mechanism operated by a movement of the bar in a direction contrary to that in which the carriage is moving, whether it be going forward or backward. The one upon the front end of the carriage only acts in this way, the one upon the other end acting in an opposite direction. In the drawing E is the draw-bar, which passes through a guide frame attached to the carriage, and has upon it a spring to hold the bar in a certain position, except when power is exerted upon it, when one spring is compressed and the bar drawn

3305




out or pushed back. The inner end of E is jointed to a lever F pivotted to a larger lever G, also held in a central position by two springs and a rod, when no strain is exerted. To one end of lever G a rod is jointed, such rod being connected by a lever to the brake levers. The fulcrum of lever G is at its lower end, pivotted to the horizontal arm of an L-shaped lever H, fulcrumed at its elbow, and its other arm extends down to the wheel axle, where it is formed with a semicircular flange. Radial arms are fixed on the axle and carry weights free to slide thereon, under the action of centrifugal force, and which act upon the flange when the vehicle is being stopped, and push the lower end of the lever H away.

**3347.** CARRYING LUGGAGE ON BICYCLES, &c., *W. R. Bull.—Dated 18th August*, 1880.—(*Partly a communication from H. F. Kimber.*) 6*d.*

This consists of a frame or hanger, forming an extension of the fork below the shaft, and serving to support a box in which the luggage is placed.

**3350.** PROPELLING AND STEERING ROW-BOATS, *W. Morgan-Brown.—Dated 18th August*, 1880.—(*A communication from M. F. Davis.*) 8*d.*

These improvements for propelling and steering row-boats relate to the oars, the rowlocks, and the foot-board, so as to enable a single rower to better

3350

FIG. 1

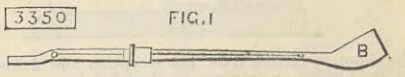
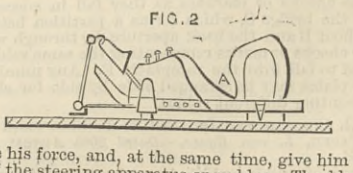



FIG. 2



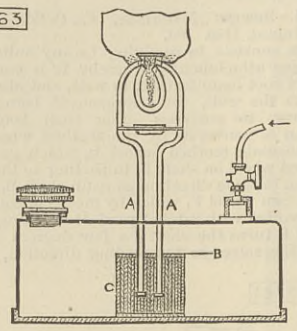

utilise his force, and, at the same time, give him control of the steering apparatus or rudder. The blade B of the oar has the shape or form shown in Fig. 1. A stay of strong steel wire or strap is secured on the face side of the oar at either end. The rower guides the boat by his foot, the apparatus being shown at Fig. 2. The foot-board A is adapted in form

to the sole of the foot of the oarsman, and is pivotted at the heel. The tiller ropes are secured to the foot-board near its forward end, one on each side. The foot-board is capable of turning on its pivot either right or left.

**3363.** Burners and Apparatus for Burning Petroleum, *F. H. F. Engel.—Dated 19th August*, 1880.—(*A communication from E. Schultz and R. Wulff.*) 6*d*.

The burner consists of a metal tube A bent so as to form a loop open at top and fastened with both its ends in a filter case C filled with layers of sponge and cotton and placed in an air-tight chamber B containing

3363

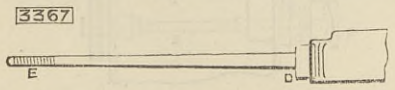



the petroleum. Pressure is exerted on the petroleum, which passes through the filter and enters the tube A through fine holes formed in the ends, passing upwards to the loop, at the lower part of which it is forced out through fine holes in a spray, which, after heating the burner, will ignite and produce flames of great heating power with hardly any smell.

**3367.** Securing Handles of Table Cutlery, *S. C. Friston and W. H. Firth.—Dated 19th August*, 1880. 6*d*.

The tang of the blade is formed with a square or oval block D under the bolster, and the top end of the

3367

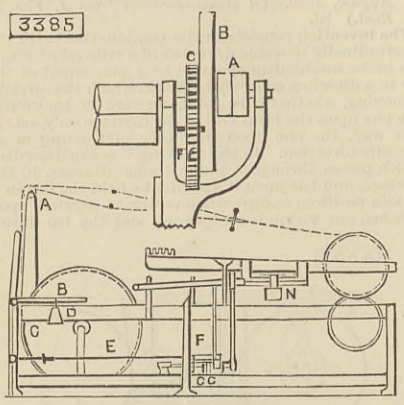



handle is made with a corresponding recess, so as to prevent its turning. The end of the tang is screw-threaded, and on to it is screwed a cap forming the end of the handle, through which the screw E passes and may be rivetted over.

**3385.** Sizing and Warping Machines, *T. W. Little and W. Townend.—Dated 20th August*, 1880. 6*d*.

This relates, First, to means for obtaining greater speed than usual, and also to avoid all strain or jerking of the threads on starting, and any slackening of the threads on stopping. For this purpose the driving pulleys A are fixed on a shaft carrying a fly-wheel B and pinion C gearing with a wheel F on the drawing roller shaft, instead of mounting the driving pulleys direct on the drawing roller shaft. The Second part of the invention relates to the regulation of the friction on the warp so as to obtain a regular and uniform length of warp, and also even cheeses, for which pur-

3385

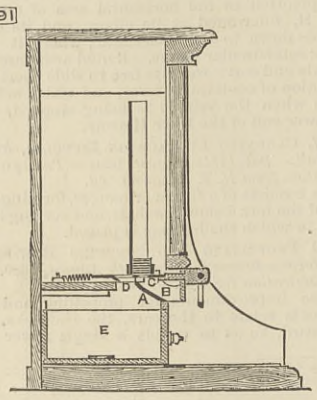



pose a feed roller A (as shown in 2nd Fig.) is placed against the warp between the cylinder and the cheese. This roller is carried by the lever B and caused to press on the warp by the weight D. The lever C connects B by the rod F to pawls F, working one on each side of the wheels G, the teeth on which run in opposite directions. The pawls F operate the wheels G, one on the upward and the other on the downward movement of the carrier arm, which is operated from an excentric. The catch wheel shaft, when driven, moves the weight N and so regulates the friction accordingly.

**3391.** Controlling Cash Receipts, *L. Von Hoven.—Dated 20th August*, 1880. 6*d*.

This relates to improvements on patent No. 2412, dated 21st January, 1877. The object is to fit within a box a plate with an aperture and with a shoot or inclined portion provided with a slot, through which, as also through said aperture, metal or like checks or markers are permitted to fall on the movement of a draw-out plate to indicate the amount to be received from a customer by one check or marker, the duplicate check or marker falling into a distinct receptacle kept under lock and key. A is the fixed plate with

3391

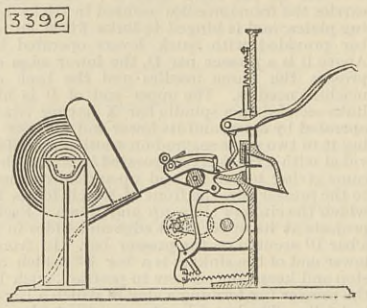



the shoot or incline B for the reception and delivery of the checks or markers as they fall in succession from the bridge C, which forms a partition between the shoot B and the back aperture D, through which other checks or marks representing the same value are caused to fall into the receptacle E. Any number of these plates may be arranged side by side for checks representing different values.

**3392.** Cutting and Delivering Tickets from Web Paper, *L. von Hoven.—Dated 20th August*, 1880. 6*d*.

A web of suitable width is perforated at intervals, and mounted upon an axle, so that the roll may be suspended upon forked uprights. The free end of the paper is then passed over a roller or guide and under a fork or pinned lever, and also under a feeding finger, the points of which are caused by lever arrangement to engage the perforations and draw a fixed quantity of paper from the reel and cause the free end to project into a hood-shaped capping, within which knives are fitted to sever the paper ticket from the web, the cutters and levers being controlled by a hand lever which can be depressed for the purpose; the return of

3392

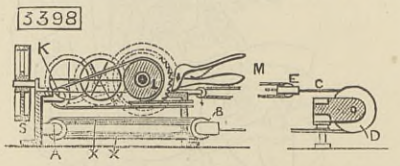


the hand lever under the action of a spring and suitable appliances ensuring sufficient paper for the next ticket to be brought over the knives that at the next depression of the lever handle it is cut off and discharged from the apparatus.

**3398.** Motive Power Apparatus, *F. H. F. Engel.—Dated 21st August*, 1880.—(*A communication from G. Duncker.*) 6*d*.

This consists of a motor driven by the resilient force accumulated by stretching bundles of india-rubber bands X. These bundles are placed round rollers A and B, the latter attached to ropes C which pass over pulleys D to pulleys E of tackles, the opposite rollers of which are fixed to the frame. The ropes C pass from the pulleys E, and are secured to the drums I, some of them first passing over pulleys K so

3398

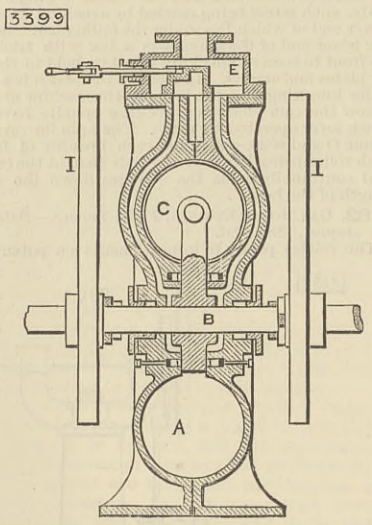



as to equalise the pressure on the drum shaft. To the drums ratchet wheels are fastened, and revolve with them loose on the shaft, being fitted with levers M by which the ropes C can be wound up, thus stretching the india-rubber bands. The motion of the drums is transferred to the drum axle by ratchet wheels and cams placed within the drums, and from the axle to the driving pulley by toothed gearing.

**3399.** Rotary Motive Power Engine, *J. Roberton, jun.—Dated 21st August*, 1880. 6*d*.

The cylinder A is of annular form made in two halves bolted together, and through its centre passes a shaft B carrying a circular piston C. The steam is admitted through the valve chest E, the slide in which has three ports, the central one leading to the exhaust and the outside ones passing down to the boss which

3399

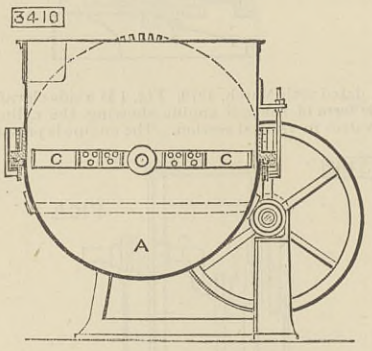



secures the piston to the shaft B, and which is formed with two opposite chambers and ports passing to the opposite sides of the piston, so that by shifting the valve the engine can be made to run in either direction. The cylinder is divided into two semicircular chambers by radial slides which are alternately moved to allow the passage of the piston by means of excentric cams I.

**3410.** Mixing, Beating, and Kneading Dough, &c., *J. Liddell.—Dated 23rd August*, 1880. 6*d*.

The water and flour are placed in the trough A, the lower part of which is dome-shaped and is made to revolve slowly, while the cutting, beating, or mixing knives G are rotated so as to act on the dough. The

3410




upper part of the trough through which the knife shaft passes is stationary. A toothed segment is formed on the trough, by means of which it can be lifted for emptying, the action being automatic.

**3411.** Locomotives for Tramways and Light Railways, *H. P. Holt and F. W. Crossley.—Dated 23rd August*. 1880. 1*s*. 2*d*.

The vehicle is mounted on four running wheels, two before and two behind, with a pair of intermediate driving wheels on an axle worked by gearing from the engine shaft. This axle is mounted in bearings in radial arms, which can be swung when desired into different positions, so that the driving wheels, while the gearing which works them remains engaged, can be moved either forwards and downwards so as to bear on the road or rails and drive the vehicle in one direction, or backwards and upwards, so as to be off the road or rails, but to bear against the peripheries of a pair of the running wheels and drive them by frictional contact, thus reversing the direction of travel of the vehicle; or the driving wheels may be held in an intermediate position, bearing neither on the road or rails nor on any of the running wheels, and so have no propulsive effect on the vehicle. The drawing repre-

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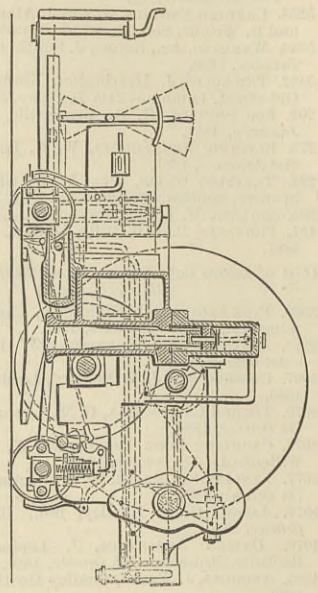

sents a gas motor locomotive constructed according to the invention.

**3448.** Portable Steam Fire Engines, *H. Merryweather and F. M. Cotton.—Dated 25th August*, 1880. 4*d*.

The difficulties experienced in raising water from a greater depth than from 16ft. or 18ft. are obviated by making the pump valve chamber A and water ways B large, so as to allow free flow of water instead of being of small capacity as compared with the barrel, as is

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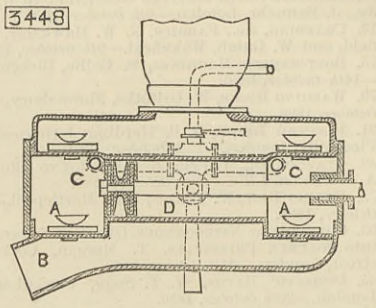
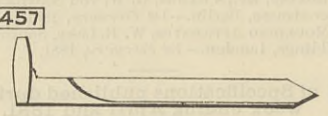



usual in ordinary portable fire engines designed to draw from a considerable depth. To each pump valve chamber is connected by pipe C an ejector D leading to the boiler, a valve cock being interposed. Communication between the valve chamber and ejector is governed by a three-way cock.

**3457.** Spikes for Railways, &c., *W. Clark.—Dated 26th August*, 1880.—(*A communication from J. P. Perkins and C. C. Jones.*) 6*d*.

The spikes are so formed as not to split the ties into which they are driven, will not make a larger hole than they can fill, can be readily and accurately driven, will hold securely, and will be economical of stock in their manufacture. The head of the spike projects in front and slightly at the side. The upper

3457



part of the spike, for a distance a little greater than the rail flange, is square, and the lower part triangular, the three sides being concaved longitudinally. The lower end is wedge-shaped, the forward side having a longer bevel than the rear side. One of the concaved sides of the triangular part is on the rear side of the spike, and in the same general plane with one side of the square part, while the other two sides cut off the angles of the square part, and converge upon the forward side to a central edge.

**3484.** Steam Boilers, *J. A. and J. Hopkinson.—Dated 27th August*, 1880.—(*Void.*) 2*d*.

So as to effect a more perfect circulation of water in boilers, they have circulating tubes extending transversely through or across the flues; the tubes are fitted at the lower end with a metal attachment, which extends to those portions of the boiler in which the "dead" water lies.

**3487.** Stoppers for Aerated Liquid Bottles, *J. Rettie.—Dated 28th August*, 1880.—(*Not proceeded with.*) 2*d*.

The stopper is formed with a ledge round the top, over which a clamp, hinged to the bottle, takes, when the stopper has been forced in to close the mouth of the bottle. Through the stopper a hole is formed, through which the bottle is charged, the underside of the hole being fitted with a valve, which the pressure of the gas inside afterwards keeps in its closed position.

**3488.** Horse Shoes, *W. E. Jones.—Dated 28th August*, 1880.—(*Not proceeded with.*) 2*d*.

The shoe is made in two separate parts connected together by a pin and slot, and one fastened to each side of the hoof, which is thus left free to expand or contract.

**3490.** Looms, *W. Adam.—Dated 28th August*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to a quicker method of weaving chenille or Axminster carpets and rugs, and consists in drawing the chenille weft from a large beam or bobbin or from a basket, instead of winding it on a stick, pirn, or quill. A bar of needles is set to the required gauge, and through the eyes the catcher or binding warp passes from the beam, which is fixed to the frame carrying the bar of needles, so as to move with it. To allow the needles to work freely and not be obstructed by the sley or reed, the latter is made in the form of a comb, the tops of which are soldered, so as to bind the teeth together in series, leaving spaces at intervals, through which the catch passes to make a shed.

**3493.** Straightening, Finishing, and Polishing Round Bars of Iron, Steel, &c., *F. Rixson—Dated 28th August*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to the application of a solid emery block or other polishing material which serves to support the bars of iron while passing to the rolls, and at the same time produces a true and uniform surface on the bars.

**3495.** Packing for Steam Joints, *C. Kesseler.—Dated 28th August*, 1880.—(*A communication from C. Schwanitz.*)—(*Not proceeded with.*) 2*d*.

The packing consists of discs of india-rubber coated with asbestos, which prevents the discs sticking to the flanges of the pipes, and protects them from ignition, while the elasticity of the india-rubber ensures a tight joint.

**3496.** Improvements in Apparatus for Obtaining Electricity, *C. W. Harrison.—Dated 28th August* 1880.—(*Not proceeded with.*) 2*d*.

The inventor employs a series of coils of conducting material, and in combination therewith an interior central bar or series of bars, the motion of which, within the coils and in the direction of their length, causes currents within them.

**3497.** Folding Gas or Tide Flaps for Preventing the Passage of Gases from Main Sewers into Lateral Sewers, *E. Willard and W. Morley.—Dated 28th August*, 1880. 4*d*.

This consists of a sewer flap or valve composed of parallel sections connected with each other in such a manner that the lowest section can be turned on the

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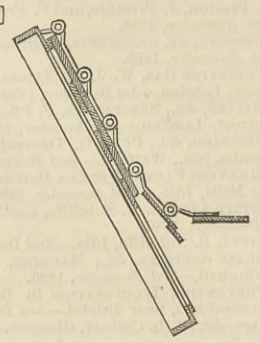

second, the second on the third, the third on the fourth, &c., by the pressure of the water or liquid acting on the flaps.

**3501.** Steam Cocks, &c., *J. C. Etchells.—Dated 28th August*, 1880. 4*d*.

This consists in arranging an annular or hollow tapered socket rising up inside the cock or valve body nearly to the top, and on the outside or inside of which the corresponding tapered plug or valve is mounted for opening and closing the necessary orifices by means of the usual spindles. This socket is entirely surrounded by a jacket or passage, through which the steam or other fluid or liquid is capable of

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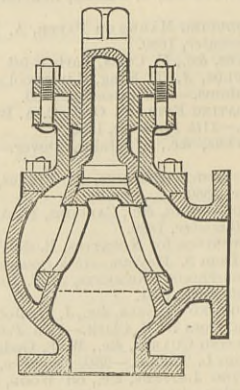

passing from the inlet side, and finds its way through corresponding openings formed in the socket and plug or valve into the inside of the said socket, and from thence to a suitable passage communicating with the open bottom of the said socket, with the outlet side of the cock or valve body, or *vice versâ*. The drawing is a sectional view of a mud cock.

**3509.** Improvements in Electric Lamps, *J. Hopkinson.—Dated 30th August*, 1880.—(*Not proceeded with.*) 2*d*.

This is an invention for regulating the distance between the carbons. Either or each carbon is carried from the piston of a hydraulic cylinder, which is so arranged as to advance the carbon when fluid enters it. The passage of the fluid into the cylinder is controlled by an electro-magnet, which may either be in principal circuit or in shunt circuit.

**3511.** Ornamenting Fictile Wares, Glass, &c., *E. Andreoli.—Dated 30th August*, 1880.—(*A communication from J. B. Germeuil-Bonnaud.*) 4*d*.

The outlines and details of the picture are traced on the plate or other article from a photographic print in any convenient manner, and flat tints applied thereto and fixed by firing, the colours used being the usual mineral colours mixed with suitable fluxes. A plate of glass is then coated with a film of a sensitised substance composed of 100 grammes distilled water, 30 grammes syrup of fecula, 15 grammes gum arabic, several drops pure glycerine, and from 10 to 20 grammes pure bichromate of potash. The film is exposed to the action of light in a printing frame under a negative of the picture, and then removed from the glass by water, colours having been first applied to it and protected by a coating of "normal-collodion." The film is then treated with caustic potash to destroy all organic matters and dissolve the bichromate of potash. The fluxes of the colours which are dissolved by the last operation are replaced by floating the film with the collodion side downwards on the top of a bath consisting of a saturated solution of borate of soda in water, to every 10 litres of which are added 25 grammes gelatine, and 100 grammes liquid ammonia. The film after this treatment is now placed on the plate with the face upwards, and the plate is again fired.

**3518.** Coloured Glass and Metallic Windows, *W. A. Barlow.—Dated 30th August*, 1880.—(*A communication from F. Dandois.*)—(*Not proceeded with.*) 2*d*.

The ornament is cut out in sheet metal and polished or plated, and afterwards applied to a sheet of glass of any desired colour, or it may be placed between two sheets of glass.

**3524.** Polishing Silver, Knives, Forks, &c., *J. Beresford.—Dated 31st August*, 1880. 6*d*.

The shaft E is driven by treadle, and carries on one end a soft mop I for polishing dish-covers or trays, and

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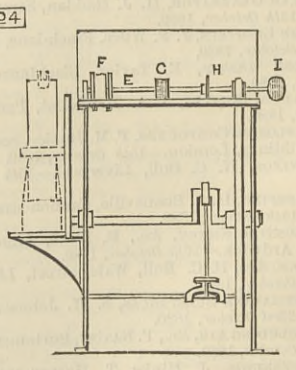


between its bearings a soft brush G for polishing and cleaning between the prongs of forks. At a short distance from the brush is a thin leather disc or polishing wheel H, and at the other end of shaft E is a hard buff or wheel for cleaning knives. The dotted lines show the application of a knife-cleaning machine driven from this machine.

**3525.** REEDS FOR WEAVING, *J. Waugh.—Dated 31st August*, 1880. —*(A communication from E. Dittrich.)* —*(Not proceeded with.)* 2*d.*

So as to impart elasticity to the flattened wires of the reed, an elastic cement is applied along the top and bottom ribs of the reed.

**3526.** STEAM VALVES, &c., *W. Morgan-Brown.—Dated 31st August*, 1880.—*(A communication from J. T. Hancock and W. R. Park.)* 6*d.*

This consists in the combination of two or more separate valves having a rigid connection with each other the relative position of the said valves to the

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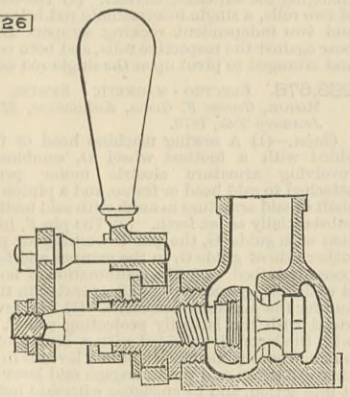

orifices which they open and close being such that their movement shall cause the orifices to be successively opened for the purpose of allowing the passage of the fluid first to one or more conduits, and then to the other or others.

**3527.** RAILWAY CARRIAGES AND WAGONS, *R. F. Fairlie.—Dated 31st August*, 1880.—*(Not proceeded with.)* 2*d.*

The object of the invention is to so construct the carriages as to greatly diminish the loss of life and limb from accidents, and also to construct wagons so as to protect merchandise, and consists in mounting the body of the carriage or wagon upon the frame so that in case of violent concussion they can slide forward thereon against the pressure of a spring.

**3528.** TREATING BUTTER, *W. L. Bradford.—Dated 31st August*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to improvements in butter workers, and consists of a fluted roller working on a circular horizontal table, one end of the roller being at the centre and the other at the periphery of the table, over which it rotates at a higher speed than the latter.

**3529.** NURSING AND FEEDING BOTTLES, *H. E. Newton. —Dated 31st August*, 1880.—*(A communication from E. A. Barton.)*—*(Not proceeded with.)* 2*d.*

The bottle is made so as to be easily cleansed, for which purpose it is divided transversely into two parts, the bottom one forming a reservoir, and the top one the nipple or end holder, the two parts being capable of sliding one into the other, and being detachable.

**3534.** TAWING OR CONVERTING HIDES OR SKINS INTO LEATHER, *F. Wirth.—Dated 31st August*, 1880.—*(A communication from C. Heinzerling.)* 4*d.*

The hides are unhaired in the usual way and then put into a solution of chromic acid, where they are left until perfectly converted, when they are placed in a solution of from 3 to 8 per cent. of a soluble carbonate, such as carbonate of sodium or potassium, to fix superficially the tanning materials. They are then dried and stretched, and afterwards placed in a solution of paraffine or the like, heated to from 26 deg. to 38 deg. Celsius in a water bath.

**3535.** PRESERVING RECORDS OF VESSELS LOST AT SEA, *J. F. Fisher.—Dated 31st August*, 1880.—*(Not proceeded with.)* 2*d.*

A globe, with a central box for a written despatch, is weighted so as to float with one side always upwards, and on this side are inscriptions of the different modes in which ships are lost, such as "stranded," "ice," "fire," &c. Over these inscriptions works a shield which covers all but one of them, so that by turning it to the required position and fixing it there by means of the lid which closes the despatch box, it will at once be evident from what cause the ship was lost.

**3536.** VALVES, *B. R. Phillipson.—Dated 1st September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to means for enabling pipes to be drained and so prevent bursting during frosty weather, and it consists of an air valve placed near the upper extremity of the pipes, and a draw-off cock at the lowest point. The valve is made of glass, stone, china, or other non-corrosive substance, so as not to be liable to become bound in its place like one formed of metal.

**3540.** SULPHURIC ACID, *J. Imray.—Dated 1st September*, 1880.—*(A communication from F. Benker.)*—*(Not proceeded with.)* 2*d.*

So as to utilise a large portion of the nitrous acid which escapes when treating nitrate of soda or potassa with sulphurous acid fumes, and also to absorb the residue so as to prevent the deleterious effects of the escaping nitrous acid, a current of sulphurous acid, in a gaseous form, is introduced into the lower part of the chamber amongst the nitrous acid fumes, when the nitrous acid gives part of its oxygen to the sulphurous acid, and converts it into sulphuric acid, while the nitrous acid becomes nitric oxide, which is completely absorbed in the sulphuric acid.

**3543.** AIR-COMPRESSING MACHINERY, *P. Evans.—Dated 1st September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to the efficient filling of the cylinders with full bodies of air at atmospheric and low temperatures, and the maintenance of such low temperatures during compression; also in utilising the heat liberated in compressing air for increasing the effective force of such air after compression; also the production of compressed air in such a state that it can be worked expansively with efficiency and economy. The cylinder is fitted with two pistons on the same rod, the air being compressed between each piston and its respective end of the cylinder, while the space between them forms a water chamber to keep the cylinder cool.

**3545.** TARGETS, *S. Foxon.—Dated 1st September*, 1880. —*(Not proceeded with.)* 2*d.*

In order to make the target self-registering, it is formed in segments, which are connected together so as to form a target of the ordinary form, but which on the impact of a bullet are forced backwards and operate mechanism connected with a registering medium, which may be either electrical or pneumatic.

**3546.** WATCHES, *L. Dee.—Dated 1st September*, 1880. 4*d.*

The watch is fitted with a dial on each side, one indicating the hours and the other the minutes, and over each moves a hand, the object being to enable the user to discover the exact time to a minute with more facility than at present.

**3549.** RANGE FINDING, &c., *W. H. Wheeler.—Dated 4th September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to apparatus for combining in one view the vision of a distant object from both ends respectively, of a constant portable base to measure the angle contained within these two lines of vision by the movement of an arm carrying a plane mirror or totally reflecting prism, adjusted over the centre on which it moves, which mirror, while placed in one line of vision and allowing a direct view of any object over it, reflects also rays from the same object as it would be seen along another line of vision, they having been intercepted and bent towards it by another mirror at the other end of the base, these mirrors having their reflecting surfaces in one parallel plane, as with the index and horizon glasses of an ordinary sextant when its index is at zero.

**3550.** PREPARING, EVAPORATING, AND CONCENTRATING SACCHARINE JUICES, &c., *F. A. Bonnefin.—Dated 1st September*, 1880. 4*d.*

For the treatment of saccharine juices previous to the evaporation of water therefrom, they are made to circulate within a pan placed inside a vessel in which a constant current of hot water is maintained, by which means all heavy organic or inorganic matters are separated therefrom. The juices thus decanted are concentrated in an evaporator, and then still further reduced in a continuous vacuum pan.

**3552.** PREVENTING THE WITHDRAWAL OF THE CONTENTS OF BOTTLES, *J. Betjemann.—Dated 1st September*, 1880.—*(Not proceeded with.)* 2*d.*

A number of claws are hinged to a plate, and their lower ends take under the collar round the bottle. Above the plate is a spindle, on which a lock of suitable construction can travel, the spindle being formed with holes to receive the bolt, and thus prevent the upward movement of the claws.

**3553.** FUEL, *C. Weekes.—Dated 1st September*, 1880.—*(A communication.)*—*(Not proceeded with.)* 2*d.*

A square hole is formed through the centre of each block of fuel, a number of which are threaded on a rod at right angles to each other, the rod being then placed in the furnace with the points only of the blocks touching the bars.

**3554.** EARTHY SILICATES, *E. Parry and T. H. Cobley. —Dated 1st September*, 1880.—*(Not proceeded with.)* 2*d.*

Sand, siliceous rocks, or slags is mixed in certain proportions with furnaced sulphate of soda known as salt cake and with small coal, the whole being burnt upon the hearth of a furnace, and when the silicate is formed it is run out, and while hot a jet of steam is thrown on it, so as to break it up and render it more soluble. It is then ground and boiled in water, the solution obtained being treated with caustic lime.

**3556.** PUMPS FOR MARINE ENGINES, &c., *W. P. Thompson.—Dated 2nd September*, 1880.—*(A communication from T. Elcoate.)* 6*d.*

The pump is of the semi-rotary or vibratory class, and is designed chiefly for use with marine engines. It consists of a shaft A driven by vibrating levers and

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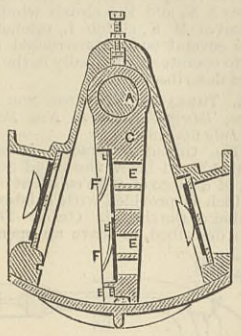


carrying a vibrating piston C forming the segment of a cylinder. Through the piston passages E are formed, and are closed by valves F. A pump of similar construction, but made double-ended, is described.

**3557.** BUTTONS, STUDS, &c., *T. Simmons.—Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

In order to make studs having the appearance of solid tortoiseshell, a thin veneer of the latter is cemented on to a disc of horn.

**3558.** SPINNING AND TWISTING WORSTED, &c., *G. Howarth and W. Cowburn.—Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

The apparatus prevents the formation of "hard waste" or doubling with the yarn of a neighbouring spindle, and also stops snarls, and conveys the draughted roving to the front rollers to be there rolled and formed into roller laps during the time the operator is occupied elsewhere. The flyers are made with conical or round bosses to steady them and prevent loose yarns getting entangled on their tops.

**3561.** STEAM TRAPS, *J. Conlong and J. Robertshaw.— Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

A hollow sphere is formed with a boss having two ports, and bored to receive a pipe or plug with two corresponding thoroughfares, one being the inlet and the other the discharge. The reservoir can turn on the pipe so as to open or close the ports, being actuated by the accumulation of condensed water in the interior.

**3562.** PRINTING COLOURS ON TWINE, &c., *J. Blakey, S. Collinge, and H. G. Grant.—Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to improvements on patent No. 3109 A.D. 1875, and consists in printing the colours upon the twine by passing it between printing faces, which are fed with colour on their peripheries by a colour roller. These faces are mounted on the bosses of a pair of clips, which are caused to slide upon and revolve with a shaft by means of curved levers actuated by cams.

**3565.** SIGNALS FOR STEAM VESSELS, &c., *C. W. Meiter. —Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to ball or shape signals, and consists in making them of a flexible material, and causing them to be distended or to collapse by means of a series of rings.

**3568.** CLOSING BOTTLES CONTAINING AERATED LIQUIDS, *T. Walker.—Dated 2nd September*, 1880. 6*d.*

This consists in closing glass bottles by moulding the exterior of the head of each bottle whilst the glass of which the head is composed is in a

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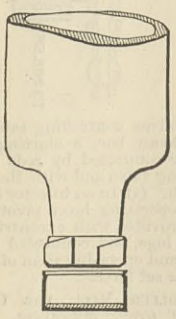

heated and plastic state, with two or more longitudinal slots or depressions through it, and with the under side of each of the parts of the head, which are left projecting, made to form inclines, by means of which a cap may be drawn against and held over the mouth of the bottle.

**3569.** OMNIBUSES, *J. Tilley.—Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

The seats inside are placed back to back, with a glass frame between them to prevent draught. The windows are made broad so as not to rattle, and above them is a shelf for passengers' use.

**3571.** STOPPING AND STARTING TRAMWAY CARS, &c., *W. D. Hartley and J. T. Hampson.—Dated 2nd September*, 1880.—*(Not proceeded with.)* 2*d.*

Gearing capable of being thrown in or out of connection with the car axle is caused to rotate a barrel, and wind up a chain attached to a spring, which is thus put in tension, while other gearing also capable of being thrown in or out of connection with the axle and barrel is employed to apply the force thus stored up so as to rotate the axle and assist in re-starting the car.

**3572.** PAPER-MAKING MACHINERY, *J. Hawthorn.— Dated 3rd September*, 1880. 6*d.*

This relates to the means for withdrawing moisture from the layer of pulp lying upon the travelling wire in the paper-making machine, and consists in interposing between the wire and the vacuum boxes a pervious apron so as to reduce the friction and increase the durability of the wire. In the main figure A are

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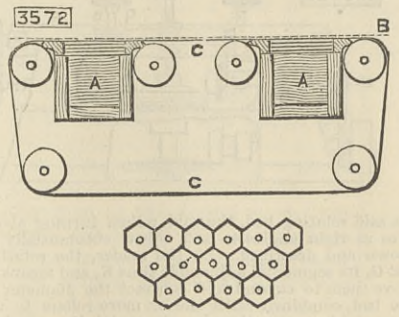


the vacuum boxes, B the travelling wire, and C the apron, preferably of perforated vulcanised caoutchouc, its upper surface being preferably honeycombed or formed with cells, with a perforation in each cell, as shown in the second figure.

**3573.** SIZING MACHINES, &c., *T. Singleton.—Dated 3rd September*, 1880.—*(Not proceeded with.)* 4*d.*

So as to ascertain when the level of the size in the size trough is too high or too low, a steam whistle is employed in combination with a revolving float, and is caused to produce a continuous whistle when the level is too low, and an intermittent whistle when it is too high. Other improvements relate to heating the size, the formation of the yarn beams, the size cock, the mode of working markers or dabbers, the maintenance of the size at a constant level, the employment of a comb between the immersion and squeezing rollers to prevent broken yarns being carried on to the squeezing rollers.

**3577.** CAGES, LIFTS, OR HOISTS FOR MINES, &c., *M. Bauer.—Dated 3rd September*, 1880.—*(A communication from L. Ricq.)* 8*d.*

This consists of four double-armed levers for each frame, each two of which are fixed on axles. The axles are put in revolution by means of a working lever fixed on one of the axles of the double-armed levers, and connected with the oppositely situated axle by a connecting-rod and small lever. According to the position of the working lever, the double-armed levers on which the frame when stopped rests will

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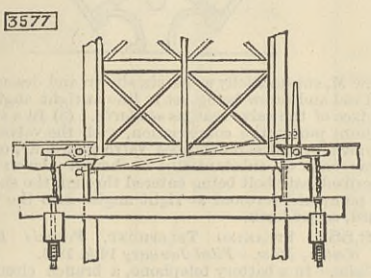

allow the frame to pass or to be stopped. Two axles act as centres for the doubled-armed levers. That end of the double-armed levers which faces the pit acts as attacking point, and their opposite end as resistance point. The resistance of the double-armed levers, that is to say, the tendency to obtain a horizontal position by virtue of the charging through the frame, is produced by means of springs fixed on the outside.

**3579.** POROUS CLAY ARTICLES, &c., *C. M. Sombart.— Dated 3rd September*, 1880.—*(A communication from G. Kukenthal.)*—*(Not proceeded with.)* 2*d.*

The articles after being formed of uncalcined clay uniformly charged with water, are brought into contact with highly-heated metallic or other plates, so as to cause a rapid evaporation of the water, and produce a number of pores in the articles, which are then burnt.

**3581.** METAL HURDLES, FENCING, AND GATES, *S. Bayliss.—Dated 3rd September*, 1880.—*(Not proceeded with.)* 2*d.*

The uprights of H or T section are punched through the web where the horizontals are to be attached, the latter being notched so as to form shoulders on each side of the web, and the flanges of the upright are bent round so that the edges bear against the shoulders on the bar.

**3582.** PROPELLING SHIPS OR VESSELS, *G. F. Harrington.—Dated 3rd September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to improvements on patent No. 2813, A.D. 1877, and consists in forming the immersed parts of the twin hulls with a bottomless longitudinal waterway between them, the immersed parts of the inward bow of each hull being formed to converge about half the water which the hulls meet upon a screw propeller working at an angle of 20 deg. between the hulls near the bows, so as to raise the water and force it backwards when propelling the vessel.

**3583.** DEPILATORY PROCESS FOR SHEEP SKINS, &c., *A. M. Clark.—Dated 3rd September*, 1880.—*(A communication from C. J. P. Desnos.)* 2*d.*

This relates to a process for removing wool from skins by a product obtained by the washing in the cold of wools in the grease, such washing yielding an almost pure alkaline soap. In carrying out this invention the water used for washing is evaporated, and the residue calcined, the product obtained when treated with water giving carbonate of potash, by the aid of which skin may be unhaired.

**3584.** HYDROGEN, &c., *C. Hessel.—Dated 3rd September*, 1880. 4*d.*

This relates to the production of hydrogen by the joint decomposition of water and hydrocarbons at an elevated temperature. For this purpose steam and hydrocarbons are injected into a heated retort, sufficient water being added either to convert the whole of the carbon of the hydrocarbon into carbonic acid, and thus liberate the hydrogen as well of the water as the hydrocarbon, or to convert the carbon of the hydrocarbon into carbonic oxide, and liberate the hydrogen of the water and hydrocarbon.

**3585.** FACILITATING THE ATTACHMENT OF JOINERY WORK TO BRICKWORK, *A. Smith.—Dated 3rd September*, 1880.—*(Not proceeded with.)* 2*d.*

Specially formed brick-carrying keys or blocks of wood are inserted in the brickwork at the points where the attachment of the joinery work is to be effected.

**3586.** REVOLVING OR ROLLING SHUTTERS, &c., *C. M. White.—Dated 3rd September*, 1880.—*(A communication from J. G. Wilson.)*—*(Not proceeded with.)* 2*d.*

The slots or laths are formed of diamond-shaped section, and are bored to receive wires on which they are threaded, distance pieces of india-rubber being placed on the wires between the laths.

**3587.** OMNIBUSES, TRAMCARS, &c., *C. Brothers.—Dated 3rd September*, 1880.—*(Not proceeded with.)* 2*d.*

The body of the vehicle is divided longitudinally by a partition, and transverse partitions further divide it into a number of separate compartments, each fitted with sashes to allow of each compartment to be shut off from the adjoining ones when desired.

**3590.** SELF-HEATING SMOOTHING IRON, *A. Norris.— Dated 3rd September*, 1880.—*(Not proceeded with.)* 2*d.*

The top and bottom can both be used for the smoothing process, the iron being so slung to the handle that it can be turned over at will. Inside the iron a lamp is hung, so as not to be turned with the iron, by which means one face is being heated while the other is in use.

**3592.** TREATMENT OF BITUMINOUS SHALES, &c., *W Ayrton.—Dated 3rd September*, 1880. 4*d.*

This relates, First, to the separation of the oily and colouring matters from bituminous shales, thus obtaining a material capable of use for purposes for which china clay is used. For this purpose the shale is ground in water so as to bring it to a stiff paste, which is then transferred to a pug mill, into which a stream of water flows. The diluted shale then flows to a series of tanks passing from one to another, and depositing its constituents according to their specific gravity. The precipitate in the second or third and following tanks is silicate of alumina, and can be used instead of china clay. The silicate of alumina thus obtained may also be used as a substitute for the whiting or china clay ordinarily used as an ingredient of the composition used in the manufacture of japanned table baize, &c.

**3593.** YEAST, *J. E. Newby and J. F. Ramsay.—Dated 4th September*, 1880. 4*d.*

This consists in the employment of esculent roots and cereal grain, the former being immersed in water and heated for about ten hours, after which they are pulverised, while the latter are reduced to a fine flour, and, after all grit has been removed, added to the roots in the proportion of two parts grain to five parts of roots, and allowed to remain for forty-eight hours in a closed vessel at about 190 deg. Fah. A hundredweight of the cereals is added to about 14 gallons of water at from 160 to 200 deg. Fah., and allowed to steep for four or five hours. A small quantity of the previous mixture is then added to the latter and causes it to ferment, the action being allowed to continue for twelve or more hours. A few gallons of water is added, the whole stirred, and then allowed to settle, the water being removed by filtration, leaving the yeast behind.

**3594.** FRAMES FOR ADVERTISING, *T. Whetstone.—Dated 4th September*, 1880.—*(Not proceeded with.)* 2*d.*

The frames of looking-glass and pictures are formed with grooves to receive pieces of wood, glass, metal, or other suitable material, on which advertisements are written or printed.

**3596.** BRUSHES, *S. Abraham.—Dated 4th September*, 1880. 2*d.*

Wires of hardened and tempered brass are used in combination with the hair or fibrous bristles.

**3599.** SMOKING TOBACCO, &c., *E. P. Alexander.— Dated 4th September*, 1880.—*(A communication from H. Berrens.)*—*(Not proceeded with.)* 2*d.*

The bottom of the bowl communicates directly with a condensing chamber containing sponge, coke, or other porous material, to the bottom of which the smoking tube is connected. The chamber has a removable stopper for introducing and withdrawing the porous material.

**3601.** DRESSING TABLES AND WASHING STANDS, &c., *L. Siegenberg.—Dated 4th September*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to the construction of tables, &c., so that they can be readily taken to pieces for packing, and consists in forming the top frame and top in the usual manner, and to the top frame the legs, footboard, and other parts are secured by means of bolts and nuts.

**3608.** TIN-PLATES, &c., *E. Parry and T. H. Cobley.— Dated 4th September*, 1880. 4*d.*

This relates to tin, zinc, or other plates, with a vitreous coating to prevent the action of acids upon them when made up into fruit tins or cases. The coating consists of an insoluble silicate or fluo-silicate and a soluble silicate or fluo-silicate, the two being mixed together and laid on the plates with a brush, or the plates may be dipped into a bath of the mixture, after which they are dried in stoves and are then ready to be made into boxes or cases.

**3613.** CHECKING RECEIPT OF MONEY, *M. Bebro.— Dated 6th September*, 1880.—*(Not proceeded with.* 2*d.*

A roll of consecutively numbered tickets is placed in a box upon a roller, and as the tickets are issued suitable registering mechanism is actuated.

**3695.** GAS, *J. F. Parker.—Dated 10th September*, 1880 4*d.*

Hydrate of lime is mixed with petroleum, paraffine oil, or any other volatile liquid product obtained by the distillation of coal, coal-tar, mineral oil, shale, or schist, and the two heated to redness in retorts, producing a permanent gas suitable for illuminating and heating purposes.

**5336.** VALVES AND VALVE GEAR FOR DIRECT-ACTING ENGINES, *J. B. Handyside.—Dated 20th December*, 1880.—*(A communication from G. H. Reynolds and T. J. Rider.)*—*(Complete.)* 6*d.*

This comprises the combination in a direct-acting engine of a main valve, an auxiliary cylinder, auxiliary pistons for moving the main valve, and an auxiliary valve adapted to be turned to admit steam to act upon the auxiliary pistons, and preferably arranged in line with the auxiliary pistons. The

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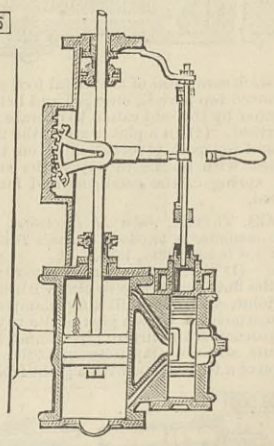


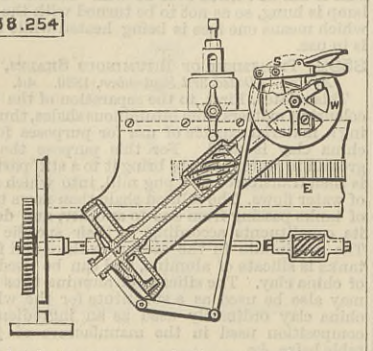
chest of the auxiliary valve may be constructed to form a cover to the auxiliary cylinder, thus dispensing with a separate cover therefor. It also comprises the combination with an auxiliary valve, a reciprocating piston rod, and an auxiliary valve stem, of an arm fixed to and projecting from such piston rod and a bar attached to the valve rod, and having in it a slot of novel form, by means of which the arm turns the valve rod as the piston rod approaches the end of its stroke. It also comprises the combination with a reciprocating piston rod of a stationary rack, and a hand-power lever adapted to engage with the piston rod, and comprising a toothed sector for engagement with the rack. The drawing shows a central longitudinal section of a steam pump embodying the invention, the water end of the pump being omitted.

## SELECTED AMERICAN PATENTS.

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

**238,254.** Mechanism for Operating the Slide Rests of Lathes, *William Sellers, Philadelphia, Pa.—Filed October 19th*, 1880.

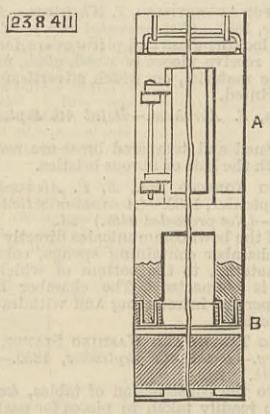
*Claim.*—In combination, a spiral pinion travelling on a splined driving shaft parallel to the traverse of the saddle, a spur wheel geared therewith and revolving freely upon an inclined shaft carried by the




saddle, a clutch to engage and disengage this spur wheel and the inclined shaft, and a spiral pinion keyed upon this inclined shaft meshing with a rack upon the shear, the combination being and operating substantially as and for the purposes set forth.

**238,411.** Door Frame for Retort Benches of Gasworks, *Albien H. Lowell, Manchester, N.H.—Filed November 2nd*, 1878.

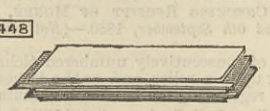
*Claim.*—(1) In a door frame for gas retort benches, the combination of an upper frame section, to which the door is hinged, having vertical legs tenoned at their base ends, with a base section adapted to be set in the floor, and provided with sockets to receive the tenons of the upper section, the connections between said two sections constituting yielding or slip joints, to counteract the expansion or contraction of the furnace walls, substantially as described. (2) In a door frame for gas retort benches, the upper section A, to which the door is hinged, consisting of a frame




adapted to be held against the wall of the retort, and provided with vertical legs tenoned at their lower ends, in combination with a base section B, adapted to be set in the floor of the furnace-room, and cast with vertical standards connected by a ledge which rests upon the floor, said standards being further provided with feet at their lower ends, and with sockets at their upper ends to receive the tenons of the upper section, the connections between said sections constituting slip or yielding joints, substantially as described.

**238,448.** Duplex Telegraph, *Gerritt Smith, Astoria, N.Y.—Filed December 14th*, 1880.

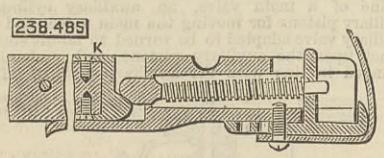
*Brief.*—A device for killing the static discharge. One pole of a condenser is attached to the main line




and the other to a supplementary artificial line, which passes to ground through the coils of the home relay, thus permitting the re-acting discharge of the condenser to neutralise that of the main line.

**238,485.** Picker Stick for Looms, *Silas C. Clatur, Manchester, N. H.—Filed July 22nd*, 1880.

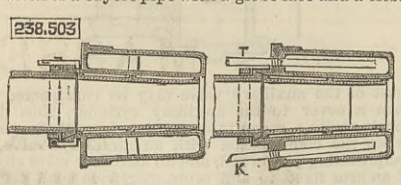
*Brief.*—In order that the picker stick may yield when a shuttle becomes trapped its upper portion is hinged to the lower portion and secured in position by the spring catch. The catch yields when the upper portion of the stick meets with resistance and permits it to turn upon the hinge. *Claim.*—(1) The compound




picker stick composed of the metal foot and catch and the pivotted top part K, engaged and held in a yielding manner by the said catch, to operate substantially as described. (2) In a picker stick, the metal foot and catch, and top part pivotted at M on the foot part, combined with means to adjust the stress or force of the spring of the catch, as and for the purpose described.

**238,503.** Tuyere, *John M. Hartman, Philadelphia, Pa., assignor of one-half to Louis Taws, same place.—Filed October 12th*, 1880.

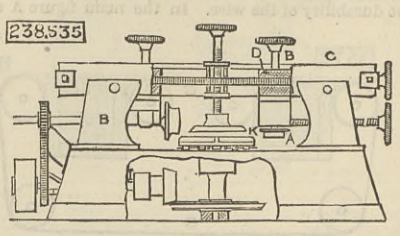
*Claim.*—(1) The combination of a tuyere with a hooked lip on the butt-end, a tuyere pipe with a collar, and a globe joint, and an oscillating clamp with hooked bolts to attach the tuyere pipe to the tuyere, whereby the expansion of the tuyere pipe cannot interfere with the joints, all as substantially set forth. (2) The combination of a tuyere pipe with a globe face and a closed




tuyere having the lug B for coupling the pipe and tuyere, as and for purposes herein described. (3) In combination with a closed tuyere, a water supply pipe K inserted at the bottom of the tuyere, and having two or more points of delivery. (4) In combination with a closed tuyere, a water discharge pipe T inserted in the top of a tuyere, and having two or more points of discharge. (5) In tuyeres having internal shields for protection of the tuyere proper, making said shield detachable, and thereby interchangeable with other similar shields when a shield becomes injured by use.

**238,535.** Machine for Flanging Circular Plates, *Martin W. Shapley, Binghamton, N.Y., assignor to James E. and Wm. M. Shapley, same place.—Filed October 25th*, 1880.

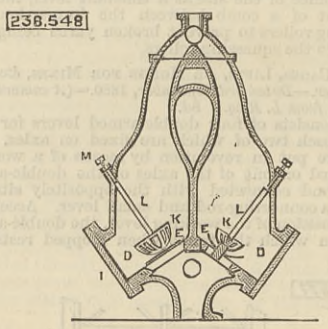
*Claim.*—(1) The rotating bed and holder between which to confine a metal plate to be flanged, and the flanged roller A, held to revolve about a vertical axis, and an adjusting screw B, and the horizontally-movable carriage in which the said screw is held, combined with the roller C, its horizontally-rotating shaft D, placed at right angles to the axes of the said bed, a carriage to hold the shaft D, and with means to move the said carriages toward and from the axis of




the said rotating bed, the said rollers turning about axes at right angles to each other, substantially as shown and described. (2) The holder, the rotating bed G, its segmental adjustable rims K, and means to move them to expand and contract the diameter of the bed, combined with one or more rollers to act upon and turn over the edge of a metal disc or plate secured to and rotated with the said bed and holder, substantially as set forth.

**238,548.** Steam Vacuum Pump, *Gardiner F. Badger, East Orange, N.J., assignor to Pulsometer Steam Pump Company, New York, N.Y.—Filed November 19th*, 1880.

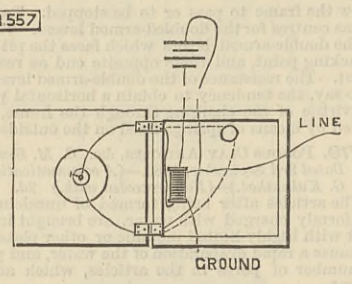
*Claim.*—(1) In the construction of a steam vacuum pump, the combination, with the induction chambers $D^1$ $D^1$ and eduction chambers H, of the upward flaring valve seats C D and detachable valve seats F G, respectively having corresponding downward bevelled edges, all arranged substantially as herein shown and described. (2) In a steam vacuum pump, as a means for holding the induction valve seats, valves, and valve guards in place, the combined rod L, and set




screw M, substantially as herein shown and described, said rod and screw being set in line at right angles to the face of the valve seat, as set forth. (3) In a steam vacuum pump, the combination, with the valve seat G, valve E, and screw tapped valve guard $K^1$, of the screw bolt O, substantially as herein shown and described, said bolt being entered through the shell of the pump and screwed at right angles into the valve guard, as set forth.

**238,557.** Speaking Telephone, *Francis Blake, Weston, Mass.—Filed January 19th*, 1881.

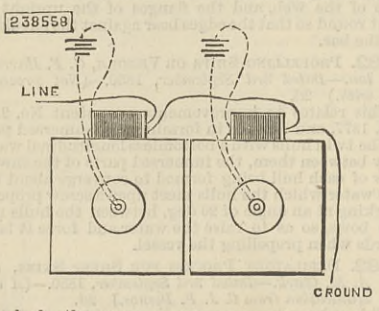
*Claim.*—In a battery telephone, a branch circuit of




proper resistance forming a bridge for the two electrodes, substantially as described.

**238,558.** Telephone, *Francis Blake, Weston, Mass.—Filed January 15th*, 1881.

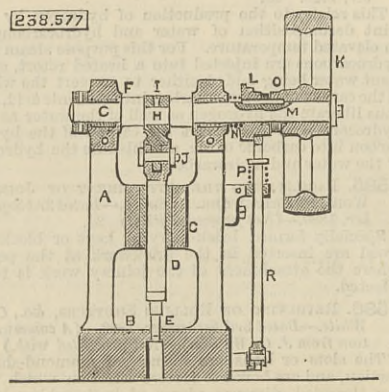
*Claim.*—The combination of two or more battery transmitters so placed as to be acted upon simulta-




neously by the same sounds, and each being in an independent local circuit, a part of which forms the primary of an induction coil, while the several secondaries are in line in the main line.

**238,577.** Machinery Clutch, *Ferdinand Du Brul, Cincinnati, Ohio, assignor of one-half to Napoleon Du Brul, same place.—Filed January 14th*, 1881.

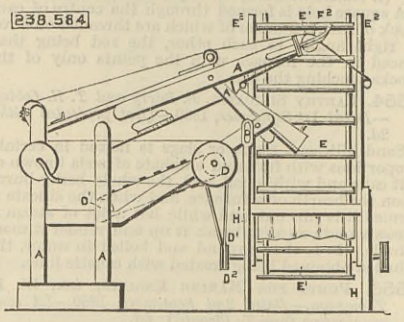
*Claim.*—(1) The combination of the clutch sleeve L, formed with inclined recess S and annular flat face $S^1$,




and the trigger R, having portion R adapted to work in said recess and pass in front of the face, to hold the said sleeve in retracted position until released, as set forth. (2) The combination of the shaft G, the sliding sleeve L, provided with key feather M, locking it to the shaft, so as to turn therewith, and the pulley K, the said key feather sliding with the sleeve, to form a clutch pin to engage the sleeve and shaft with the pulley, as and for the purpose set forth. (3) The combination of clutch sleeve L, having gradually deepening inclined recess S and flat face $S^1$, the loose drive pulley K, and self-locking trigger R, under control of the operator. (4) The device G, for adjusting the shaft and plunger, in combination with the clutch sleeve L, formed with inclined recess S and flat face $S^1$, and adapted to be held in disconnection, as set forth. (5) The treadle Q, in combination with the trigger R, spring P, and clutch sleeve L, having flat face $S^1$, the said trigger adapted to hold the said sleeve in retracted position until released by the said treadle, as set forth.

**238,584.** Straw Elevator, *Michael F. Hartman, Henrietta, Pa.—Filed August 11th*, 1880.

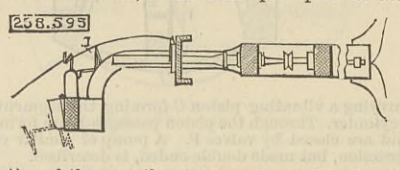
*Claim.*—(1) In a straw carrier or elevator, the combination, with the standards $E^2$ and frame A, of the supporting standard H and adjustable standard $H^1$, both of said standards provided with sharp lower




extremities, substantially as and for the purpose herein shown and described. (2) The combination, with the elevator E $E^1$ $E^2$, of the brackets F F, provided with swivel pulleys $F^1$ $F^1$ having guard fingers $F^2$ $F^2$, ropes X X, and the clutch windlass composed of the sleeves M K, clutch L, ratchets $K^1$ $M^1$, and pawls, the several parts constructed and relatively arranged to operate substantially in the manner herein shown and described.

**238,595.** Thread Contractor for Spinning Machines, *Edward Kilburn, New Bedford, Mass.—Filed July 6th*, 1880.

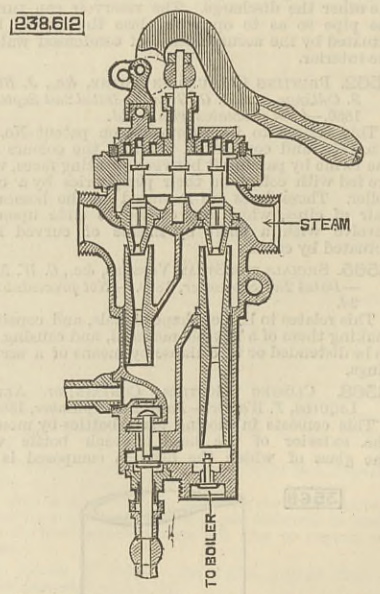
*Brief.*—The thread contractor is secured to the hinged guide board below the usual guide eye, and is composed of a piece of wire coiled at one end to form a ring, which is provided with a lateral opening for the insertion of the thread. *Claim.*—The contractor I, formed as described, to leave an open space for the




insertion of the yarn therein laterally, combined with the hinged guide board and its guide eye located above the contractor, and with the ring rail, ring, and traveller, and with the spindle to turn the bobbin upon which the yarn held within the said contractor is being wound, substantially as described.

**238,612.** Injector, *Louis Schutte, Philadelphia, Pa.—Filed December 20th*, 1880.

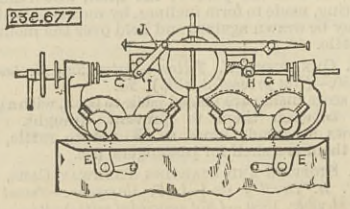
*Claim.*—(1) In a duplex injector, substantially such as shown, the combination of two separate steam inlet valves and a loose bar or lever connecting said valves, all enclosed within the injector, and an operating device located on the outside of the injector and united with the device connecting the valves, substantially as described and shown. (2) In a duplex injector, the combination of two steam admission valves, a loose bar or lever forming a direct connection between said valves and starting valve, and a rigid direct connection between the starting valve and the bar which connects the steam valve, substantially as described and shown. (3) The herein described injector, consisting of two parts, one discharging into the




other, steam valves controlling said parts and connected by a loose bar, a starting valve, and an operating lever connected by rods or links directly with the starting valve and with the loose connecting bar, as set forth. (4) In an injector substantially such as shown, an operating lever pivotted to a jointed support, and provided with excentric lugs and links encircling said lugs, and connected directly with the starting valve and operating stem of the steam valves, substantially as set forth.

**238,677.** Roller Mill for Grinding Grain, *William D. Gray, Milwaukee, Wis., assignor to Edward P. Allis, same place.—Filed December 24th*, 1880.

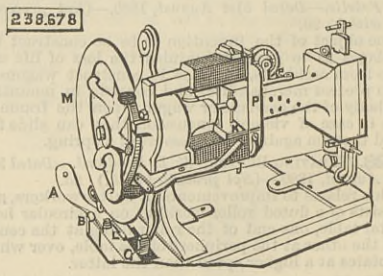
*Claim.*—(1) The combination, in a grinding mill, of




two parallel rolls geared to run toward each other at different speeds, said rolls being both provided with continuous spiral ribs running in one and the same direction, the ribs of the fast roll having substantially upright faces on the front sides, and the ribs of the slow roll having substantially upright faces on the rear sides. (2) In combination with the swinging roll supports E and the rods G connected thereto, the excentrics H, shafts I, and rod K. (3) In combination with the movable roll supports E and the rods G adjustably connected thereto, a transverse shaft I, provided with two excentrics connected to the rods G at opposite ends of one roll, whereby the roll may be thrown into and out of action instantly without changing the adjusting devices. (4) The combination of two rolls, a single intermediate rod below the rolls, and two independent rocking scrapers arranged to bear against the respective rolls, and both constructed and arranged to pivot upon the single rod as shown.

**238,678.** Electro-magnetic Sewing Machine Motor, *George F. Green, Kalamazoo, Mich.—Filed January 30th*, 1879.

*Claim.*—(1) A sewing machine head or frame provided with a toothed wheel O, combined with a revolving armature electric motor permanently attached to said head or frame, and a pinion $N^1$ on the shaft of said armature in mesh with said toothed wheel, substantially as set forth. (2) The pin F, in combination with guide G, the pin F working or passing on either side of guide G, in the manner and for the purposes described. (3) The combination of levers A and B with spring and pad L, all operated in the manner and for the purposes described. (4) The lever B, provided with the laterally projecting pin F, combined with the lever G, provided with a lateral offset and a notch, whereby the motion of said lever B in one direction will cause said pin to engage said lever G to push it into action, and by engaging with said notch hold it in action, and by a continued motion of B said pin will be passed over and disengaged from said lever G and return to its initial position by the other side. (5) The wheel M on the sewing machine shaft, combined with the lever B, provided at its end with a pad or brake L, capable of striking said wheel on one side of




a line vertical as to its centre, and the buffer, capable of striking said wheel on the other side of said vertical line, whereby a movement of said lever in the same direction may either stop or start said wheel, as set forth. (6) The levers A B, pivotted with same axial line and coupled together by offsets or lugs S, in engagement when said lever A is moved in one direction, but disengaged when said lever is moved in the other direction, combined with the bumper C and pad L, on the lever B, whereby the machine may be stopped or started by a movement in the same direction, or the lever folded to be out of the way during storage or transportation.

## CONTENTS.

The Engineer, April 8th, 1881.



The South Australian Ministry have consented to pay the Orient steamers one shilling per ounce for letters, one shilling per pound for parcels, and sixpence per pound for newspapers, despatched from Adelaide, conditional upon a fortnightly mail service being conducted.

South Kensington Museum.—Visitors during the week ending April 2nd, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,280; mercantile marine, building materials, and other collections, 3717. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 1600; mercantile marine, building materials, and other collections, 283. Total, 15,880. Average of corresponding week in former years, 14,662. Total from the opening of the Museum, 19,800,968.