THE HUNGARIAN MILLENNIAL EXHIBITION, BUDAPEST, 1896.

(*From our Special Commissioner.*)

Revenons à nos moutons and see what information may be gathered from a further inspection of the spacious machinery hall of the Hungarian Exhibition. This hall houses part of Group IX., which consists of machinery, industrial and scientific instruments and apparatus; in the first section there are 215 exhibitors, in the second section 55. Of the 215 which may be taken as fairly representative of the industry in Hungary, the largest number of exhibitors in one class of machinery—about 40—shows agricultural machinery and appliances. The one occupying a central position, with an imposing structure, and display of threshing machines, portable engines, and a varied and extensive show of smaller agricultural appliances, is the First Hungarian Agricultural Machine Manufactory Joint Stock Company. This company was founded in 1882, employs 800 hands with 150-horse power, and produces some 3000 different machines yearly, of a value of one and a-half million florins, which are exported to the Balkan States. To the north of this exhibit is that of E. Kühne, of Monson, who shows ploughs, harrows, rolls, plain and otherwise, and other soil preparing appliances; drills, and broadcasting seed sowers and manure distributors; hay rakes, tackle and gear for horse-power; dressing mills and riddles; and machines for preparing food.

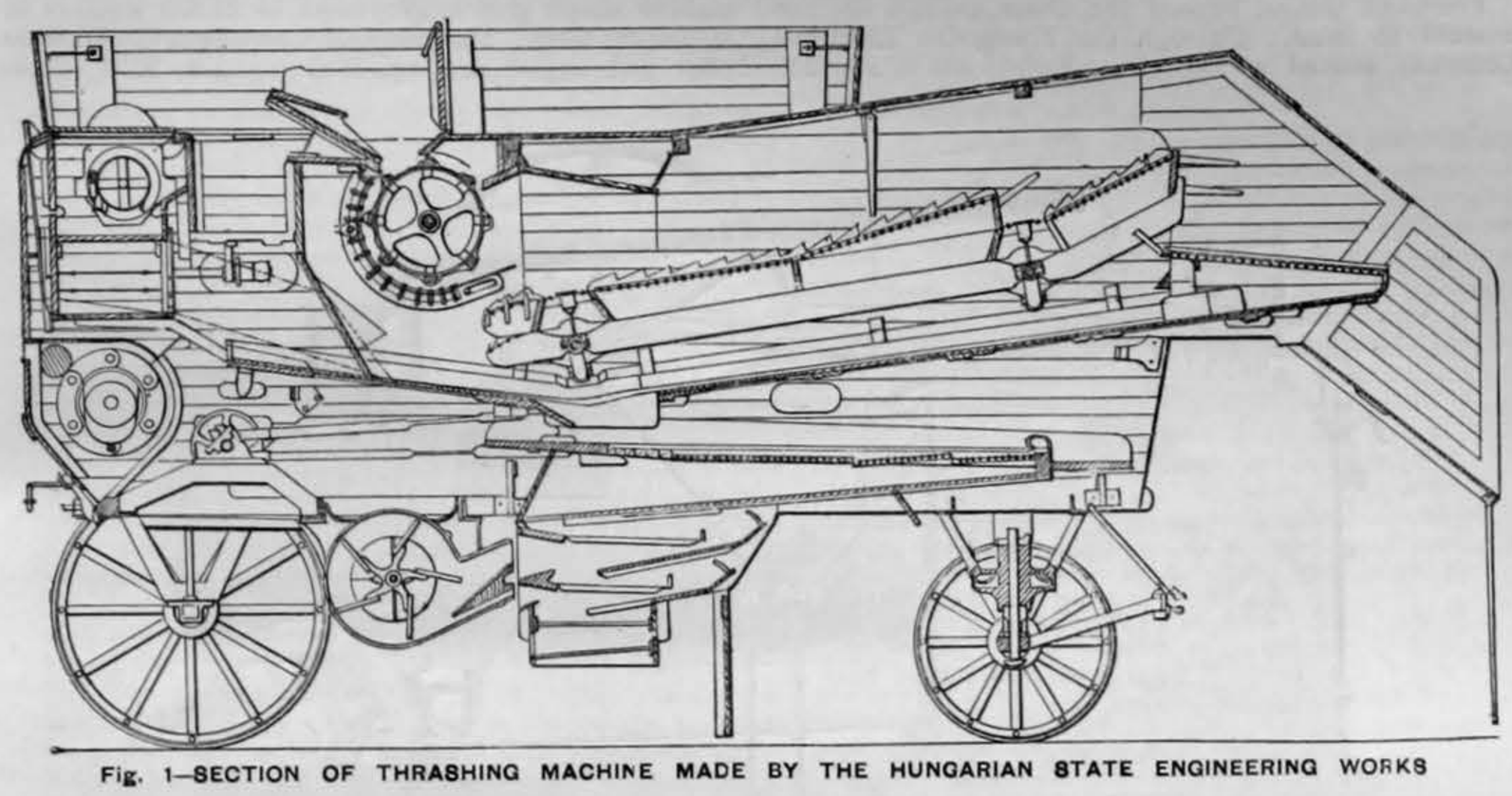


Fig. 1—SECTION OF THRASHING MACHINE MADE BY THE HUNGARIAN STATE ENGINEERING WORKS

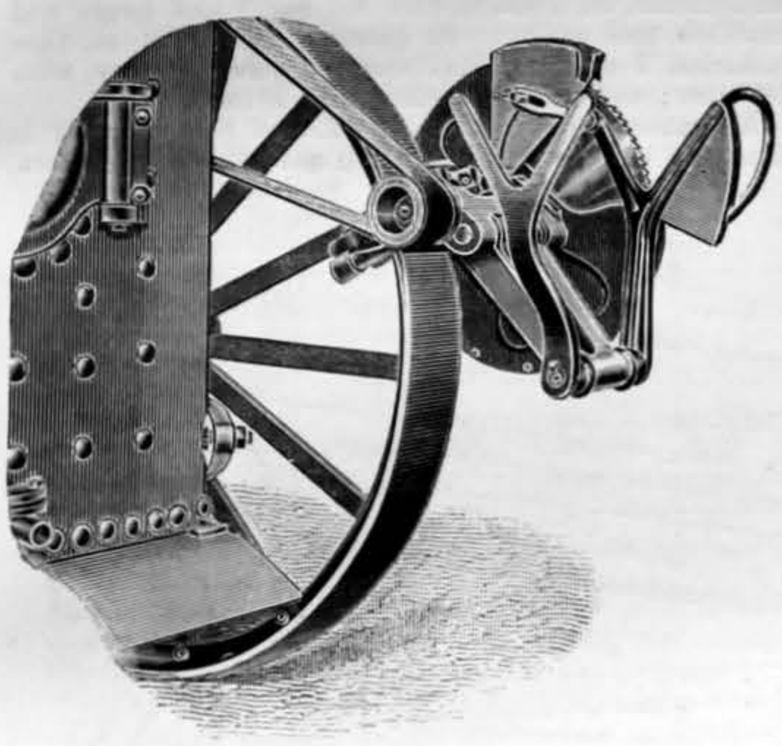


Fig. 2—CIRCULAR SAW FOR FIREWOOD CUTTING

Kühne's factory was started in 1856, and now employs 400 workers and 100-horse steam power; exports to Austria, Roumania, and Servia, and has many patents for small points. On the other, the south side of the First Hungarian Company, is a similar show of appliances emanating from the firm of Mayer and Sons, who also show oil and wine presses. With regard to these exhibits, they are remarkable for their diversity, things almost primitive being found alongside most recent refinements and appliances. A great feature, too, is the grading of the implements, so as to suit the requirements of the smallest farmer or of the great landed proprietors. Thus one finds little corn-dressing machines for hand-work, larger ones for one-horse or two horses, up to 20-horse steam-power threshing machines; there is a great business in the smaller ones.

The best threshing machines are made at the State factory; they differ but slightly from the usual form, as will be seen from Fig. 1, which is a section of one of Hungarian make. They are built on a strongly constructed angle iron frame, upon which all the moving parts are supported, all bearings being spherical bearings; all shafts are steel, and so is the drum, whilst the concave is wrought iron, and adjustable from the outside to suit the corn being threshed. Great stress is laid on shaking the straw, therefore the course of the beaten straw on the shakers is not only broken; but beyond, it falls on a shaking table, which consists, when necessary, of a wooden sieve, so that as much corn as possible gets shaken out. The caving riddle consists of crossed wooden staves or slats, whilst from the riddle the corn and chaff encounter directly the current of air and otherwise as usual. The chief measurements of the machines made and the price they are sold at are set forth below.

Size.		48in.	54in.	60in.	68in.
Length of drum		1210	1360	1510	1700
Diameter of drum		550	550	550	600
Revolutions of drum per minute		1050	1050	1050	950
Length	Of machine ready for transport	5560	5840	5850	6700
Breadth		2160	2350	2500	3050
Height		3000	3200	3200	3400
Weight		tons. 4	tons. cwt. 4 13	tons. cwt. 4 18	tons. cwt. 6 5
Price about		£177	£195	£212	£250
Price with 6, 8, 10, or 12-H.P. portable engine respectively		£396	£450	£510	£590

Measurements are given in millimetres, the measurement the machine is made to.

The price includes all spanners, small belting, chaff and zinc sieves of the two awners with which these machines are fitted, the extra straw sieve, wheel and side wedges, oil can, screws, iron supports, lengthening boards with wooden supports, three side boards, two chaff boards, straw boards, protecting boards for driver, two small and one large ladders, shaft and trestles, and a waterproof cover.

The engines are either for wood or coal burning. Fig. 2 shows the arrangement of the wood-cutting saw, to which I have previously referred in THE ENGINEER, July 17th, 1896, page 51. It is attached by means of a stirrup and screws to the back wheel of the engine, and is driven by a pulley keyed to the driving shaft; it is very portable, easily placed in condition for working, and delivers the cut wood just where it is wanted—all favourable points. The engines exhibited are in great variety, portable, also semi-portable, with cylindrical or rectangular fire-boxes, for straw, fed from above or below by hand or mechanically, for sawdust, for wood or coal firing, simple or compound. Fig. 3 shows a section of a portable engine, with cylindrical fire-box, which I give as an example of the engines manufactured at the State works; it is for coal firing, but can be used with wood; the fire-box is a corrugated iron tube, which, on account of its circular section and great strength, requires no external stays. The grate has a somewhat sharp incline, and rests on a cast steel support, which also carries a fire-brick bridge; the space below this is closed by a trap-door to prevent the entrance of cold air. The space around the grate is sufficient to prevent the direct contact of flames with the walls, to allow of a better combustion of smoke, and to provide for the deposition of soot, and so as to prevent a clinker ash stoppage of the tubes. The plate closing the furnace and ash space is attached to end of the boiler by three screws, and carries the fire and ashpit doors, the latter being arranged to admit air as required. For inspection and cleaning manholes and mud cocks are provided on all sides. There is a spark-catching chamber with wire gauze diaphragms in front. The pressure for a 9-H.P. engine is six atmospheres. The situation of the cylinder is at the back over the fire-box in the long axis of the boiler; there is a safety valve on the top of the cylinder and another near and connected by a little tube with the inside of the funnel. A slide valve worked by a lever serves for starting or stopping. The crosshead is cast steel, the guide and supporting foot cast iron. The crank shaft is forged out of a single piece of Diosgyör steel, upon the excellence of which I have already expatiated. The chief bearings, which at the upper part incline inwards at an angle of 45 deg., are attached by screws and wedges to soft steel supports which are bolted to the boiler. The Tangye-Pickering governor is used. The feed pump is fixed to a cast steel plate, is provided with ball valves, and can supply water at a temperature of 176 deg. Fah. The boiler plates are of Hungarian mild steel, and parts, otherwise of cast iron, or Diosgyör cast steel. The engine can be used either mounted on the usual carriage with iron wheels, or fixed on cast iron feet. Here are some particulars of engines of this type, dimensions in millimetres.

	9-H.P.	12-H.P.
Boiler: Heating surface	202 sq. ft.	210 sq. ft.
Grate area	6·88 sq. ft.	3·5 sq. ft.
Number of smoke tubes	44	44
Effective pressure	6 atmos.	6 atmos.
Engine: Diameter of cylinder	240 mm.	270 mm.
Stroke	300 mm.	300 mm.
Fly-wheel diameter	1600	1800
Fly-wheel face	195	200
Performance: Revs. per min.	140	140
Brake horse-power	27·3	31·5
Water per brake horse-power and hour	3·61 gallons	3·65 gallons.
Salgó-Tarján brown coal per brake horse-power and hour	9 lb.	9·1 lb.
Weight of empty engine	5 tons 10 cwt.	5 tons 16 cwt.
Length of mounted engine	4500 mm.	4950 mm.
Width of mounted engine	2000	2000
Height of mounted engine	2800	2800
Height of mounted engine with chimney up	4800	4900
Price, portable, about	£275 16s. 8d.	£340
Price, semi-portable, about	£265 3s. 4d.	£329 11s. 8d.

Price includes firing implements, tube brushes, filling funnel, wedges, pre-heating tube, suction tube with rose, waterproof cover, spanners, hammer, three reserve gauge glasses, oil can, grease pot, shaft pole, two trestles, &c. When taken as semi-portable, the wheels and axles, the shaft and trestles, and waterproof cover, are lent during the transit, but have to be returned.

Fig. 4 is an illustration of a 14 or 16-horse power compound engine from the same factory, and is much of the same character as the one just described; the chief particulars being, dimensions in millimetres:—

	14-H.P.	16-H.P.
Boiler: Heating surface	225 sq. ft.	278 sq. ft.
Grate area	10·38 sq. ft.	Variable
Number of fire-tubes	52	54
Effective pressure	10 atmos.	12 atmos.
Engine: Diameter of cylinder	180:270 mm.	200:300 mm.
Stroke	360	360
Fly-wheel diameter	1800	1900
Fly-wheel face	200	230
Performance: Revs. per min.	140	140
Brake horse-power	36	50
Water per brake horse-power and hour	27½ lb.	25⅓ lb.
Salgó Tarján coal per brake horse-power and hour	6·82 lb.	6·31 lb.
Weight of empty portable engine	8 tons	9 tons 2¼ cwt.
Length of mounted portable engine	5000 mm.	5200 mm.
Width of mounted portable engine	2250 mm.	2350 mm.
Height	2200 mm.	2250 mm.
Height with chimney up	5000 mm.	5100 mm.
Price, portable	£466 13s. 4d.	£569 3s. 4d.
Price, semi-portable	£441 13s. 4d.	£552 10s.

The same conditions obtain with the compound as with the simple engine, in connection with the purchase as a portable engine. I should add, that there are about twenty exhibitors of corn and seed threshing and dressing machines. Amongst these is Robey and Co., who exhibit threshing machines at the end of the hall; one of them, the Record, an invention of Mr. Harding, the manager of the Budapest branch establishment, is intended for the threshing, &c., of clover and such like seeds. Fig. 5 is an illustration of this machine, and it performs all the operations of separating the pods from straw, shelling the pods, separating, cleaning, and sacking the seeds ready for market in the single machine. The material is fed as in the ordinary threshing machine, and the pods are detached from the straw by a peg drum *a*, and a peg concave *b*, the straw proceeds along shakers *e e*, seeds, pods, &c., falling through, drop into a shaking table *f*, and meet the material coming through the concave on a riddle *g*, which separates short straw from the seeds and pods, and they fall into a channel *h* that delivers them into a shelling drum *c*, and a shelling cylinder *d*. The shelled seed and pods are raised by an elevator *i* to the first dressing apparatus *k*, consisting of three sieves 1, 2, 3, having a 3in. reciprocating motion, actuated by a crank *j*, with a 3in. throw that also moves the shaking table *f*. A fan *l* supplies the necessary air for winnowing, and the partially cleaned seed resulting from this treatment is elevated by a small elevator *m* into the second dressing apparatus *n*, consisting of a series of fine sieves and a fan, from which the seed is delivered into sacks ready for market. In this case also the material has been duly considered, and the moving parts are supported on iron framework, the bearings being extra large, and lubricated automatically with solid grease by means of a spring lubricating-box. For inspection and renewals or repairs all parts are placed in accessible positions. The machine presents a very good appearance, weighs 2 tons 16 cwt., and is sold at £141 13s. 4d. Of our manufacturers no others exhibit; nevertheless, I noticed a few odds and ends by Clayton and Shuttleworth outside the Bosnian Industry Hall.

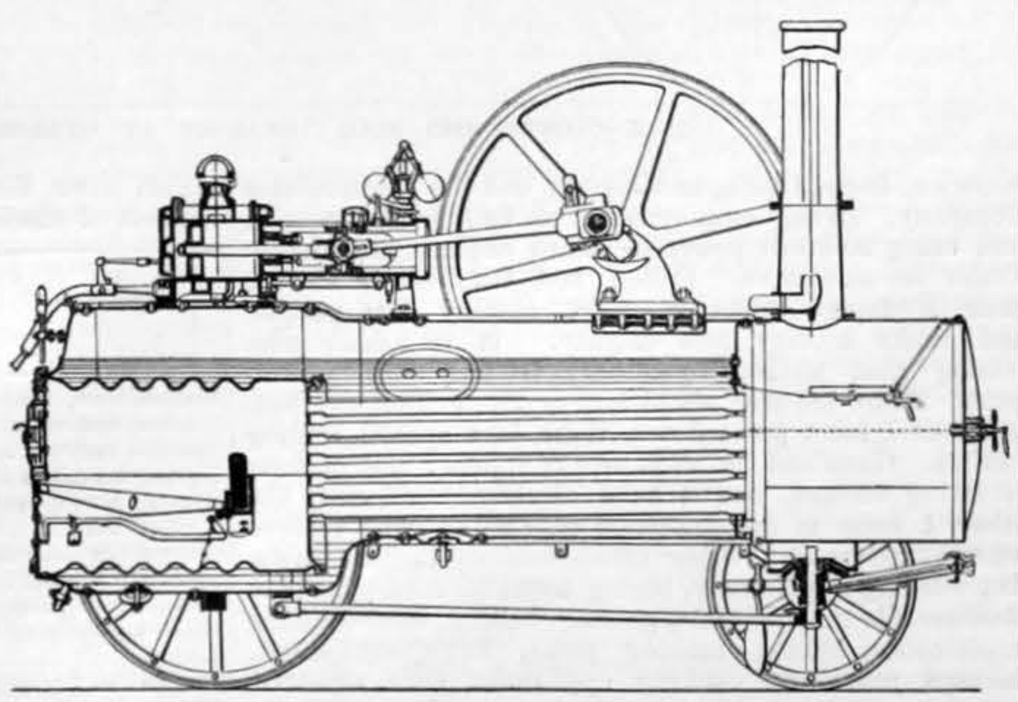


Fig. 3—SECTION OF PORTABLE ENGINE FROM HUNGARIAN STATE WORKS

Although not represented in the Exhibition, I must not pass over the name of John Fowler and Co., whose position as makers of steam ploughs is as yet unassailed, and owing to the kindness of, and under the conduct of Mr. George Turner, I was enabled to visit their new offices and residences and shops at Kelenföld, a short but pleasant drive from Budapest, or accessible by train, the station being just in front of the offices and residences, which are in a handsome grey stone house, and the shops and store are of suitable proportions to house, erect, repair, &c., the giants the firm create. I must say the visit was agreeable, for it made me feel that there was indeed nothing to be ashamed of in British work; the solidity and thoroughness of the construction, the way details are attended to, show that not alone is the work to be done well understood, but also that the machines are constructed to do that work, and not merely for show—a gratifying fact. There was one colossal machine there for turning a furrow 27in. deep.

The exhibit of agricultural machines and steam engines of the Nicholson Machinery Factory Joint Stock Company leads me to the exhibitors of steam and other engines, about twenty in number, three showing petroleum and two gas engines. The Nicholson business was founded in 1870. It employs 640 hands and 200-horse power in steam engines, exports to Austria, Roumania, and Servia, turns over a million and a-half florins annually, and holds patents for steam engines, steam boilers, threshing machines, and sowing machines. In addition to an excellent agricultural exhibit, they have one 200-horse power compound condensing horizontal engine, two 300-horse power compound vertical engines, and a smaller simple condensing vertical engine, all working at the electrical central station; whilst in the boiler-house they have in use a Simonis and Lanz steam boiler. Neighbours of Nicholson are the Schoenichen Hartmann Hungarian Ship, Machine, and Boiler Building Joint Stock Company, which exhibits marine engines at work, and contribute to the electric central and have a boiler at work. This firm was established in 1874, employs 1200 workpeople, and 210-horse power in steam engines, exports to the East and Russia, and makes annually, besides dredging machines, reservoirs, locks, and steam engines, five steamers, thirty-eight other vessels, boats, and tugs, of a value of 1,200,000 fl. Stefan Röck in the vicinity has a varied show, steam engines, boilers, cooling apparatus, and presses for bricks, tobacco, oil, and wine, engines and dynamos, has a Cornish boiler at work, and an ice installation. But of all these, the "Danubius" Hungarian Ship and Machine Construction Joint Stock Company makes the finest exhibit. It has a Babcock and Wilcox and a Tischbein boiler in the boiler house, a 350-horse power compound marine engine, pumps, cement mills, petroleum refining apparatus, portable railway parts, bridges, and iron construction material. The iron construction of the machinery hall, of the Croatian Art Gallery, and parts of another building are from this factory; it and some others also exhibit in Group X.—land and water communication. This company founded in 1890, employs 1000 workpeople and steam engines to 200-horse power; exports parts of ships' boiler and machinery appliances to Roumania, Bulgaria, Servia, and Germany, turns over 2,200,000 florins, and has patents for boilers and portable railways. L. Lang's machinery factory and foundry was started in 1868, and now gives occupation to 350 people, and steam engines to the extent of 50-horse power; he exhibits steam engines, pumps, and steam superheaters. There is a Schmidt engine shown, and also a 200-horse power triplex steam engine with condenser. I have already drawn attention to Eisele's boiler exhibit and the petroleum and gas engines, portable petroleum engines, &c., of the First South Hungarian Machinery Company, a company started in 1894, and employing seventy workpeople and a 10-horse power semi-portable engine, producing from 60,000 to 80,000 florins worth of petroleum and gas engines, &c. yearly.

Tools or machine tools or fittings are shown by fifteen exhibitors, to the most prominent of which I have already called attention. The Vulcan Company was founded in 1885, and employs 500 workpeople in Budapest and the same number in Vienna, besides 150-horse power in steam engines; it exports machine tools and milling machinery to Austria, Bulgaria, Switzerland, Russia, India, and America. Hirsch and Frank, the other firm having a prominent show of machine tools, were established in 1882, employ 250 people, make a yearly turnover of 300,000 florins, and export to the Balkan States and Austria; whilst the Waffen and Maschinenfabrik Company, founded in 1888, employ 1500 people and steam engines to 400-horse power. The First Hungarian Screw-making Company, established in 1889, gives employment to 260 people, and uses 400-horse power in steam engines, works up to 2500 tons of raw material, worth £50,000, and exhibits screws, parts of carriages, and railway constructions, and forgings. J. L. Brunner and Co. show parts of machines, carriages, both in wrought and cast iron, also scales; this firm was established in 1883, employs 130 people and 18-horse power mechanical, makes 5000 pairs of scales, and 300 tons of castings annually. There are some ten exhibitors showing pumps, and as many showing fire engines and spraying machines. The Budapest Pump and Machinery Factory Company makes a good show; it started in 1858, employs from 400 to 600 people and 130-horse power in steam and electrical engines, and exports to the East.

There are nine exhibitors of distilling and brewing appliances, five of soda-water machinery; amongst the latter the ubiquitous "Sanitas" Company. Judging from the exhibits the millstone industry is of importance; there are some seven or eight exhibitors, one having French stones. Water-wheels and turbines are exhibited by three firms, Ganz and Co. and Wörner and Co. being prominent. The former firm have such a varied and extensive exhibit, that it will require a special notice, more particularly as I have had the opportunity of visiting their works, which are of considerable interest, and will be noticed at the same time. The latter company was established in 1867, and has 500 workpeople and 100-horse power in steam engines. There are also bicycle makers; Fuchs and Brigantig, founded in 1894, employ six people, make annually 150 machines, the "Hungaria" velocipede, worth £1750; another firm makes the Villam machine, Johann Puch and Co. make 600 machines a year, employ fifteen people, and started last year. There is nothing striking in these exhibits.

Electrical things, beyond the Ganz exhibit, do not amount to much; although the Hungarian Electrical Company, started in 1893, gives employment to over 200 people, has various establishments, having 3000-horse power in Budapest, 390-horse power in Fiume, 300-horse power in Fünfkirchen, and 300-horse power in Erlau. The value of the electric current produced in the first two establishments amounts to £46,250 a year; whilst the Electric Glow Lamp Factory Company, established in 1889, employs 200 people, 100-horse power in steam engines, produces 1,200,000 lamps a year, worth some £37,500, which are exported all over Europe, and to America, India, China, and Japan; and the Accumulator Company, giving employment to twenty-five people, and using 20-horse power in steam engines, and makes Tudor accumulators. Felten and Guilleaume started their Budapest works in 1896, employ 150 people, and make a very fine display. It is rather surprising that milling machinery is not very prominent. There are only about four or five exhibitors; but, then, as I have pointed out, there is a special milling exhibit. Ganz and Co. show sets of rollers; and of their vibrating screens, one I have already mentioned, the other I hope to get drawings of, and so will reserve remarks about it. Other small exhibits include saws, flax working implements, boring tools, tube cutters, tube cleaners, file making tools, gearing, belting, wool-dressing implements, button-making press, forge equipment, sausage machines, cooking appliances, boot cleaners, coffee roasters, washing machines, ventilators, sewing machines, and cement mills.

I have endeavoured in these remarks to convey some idea of the character and position of the machinery industry of Hungary as indicated by the exhibits under Group IX. It will be specially noted how very young most of the enterprises are, and, in fact, furnishes further evidence of the awakening of Hungary from its years of torpor, during which it was regarded as a producer of raw material, and not to be taken into consideration at all from an industrial point of view. It is noteworthy, however, that Hungary was the first continental country to introduce the steam engine into its mines, the first being erected in 1722 by an English mechanic, Isaac Potter. Hungary also produced various inventors, but for the reason just given their inventions did not receive the necessary encouragement. However, in the census of 1880, 4701 people are recorded as being engaged in the machinery industry, 2677 of whom were masters, there being only 2024 helpers; in the census of 1891 these numbers had risen to 3511 masters and 21,266 helpers. It is now estimated that the Budapest machine shops give employment to 22,300 workers at the present time. The principal occupations in 1891 were boiler and engine making, 1882 masters, 9354 workpeople; shipbuilding, 9 masters, 2600 men; agricultural repairing shops, 36 masters, 532 men; railway repairing shops, 16 masters, 4036 men; scientific tools and implements, 58 masters, and 363 men; tool forges and machine tool makers, 69 masters, 178 men; carriage factories, 2 masters, 2147 men; a screw factory with 183 men; and an arms factory with 46 men.

A further insight into the position of this industry in Hungary will be gathered from the following numbers, which show the weight and value of the imports and exports of machinery:—

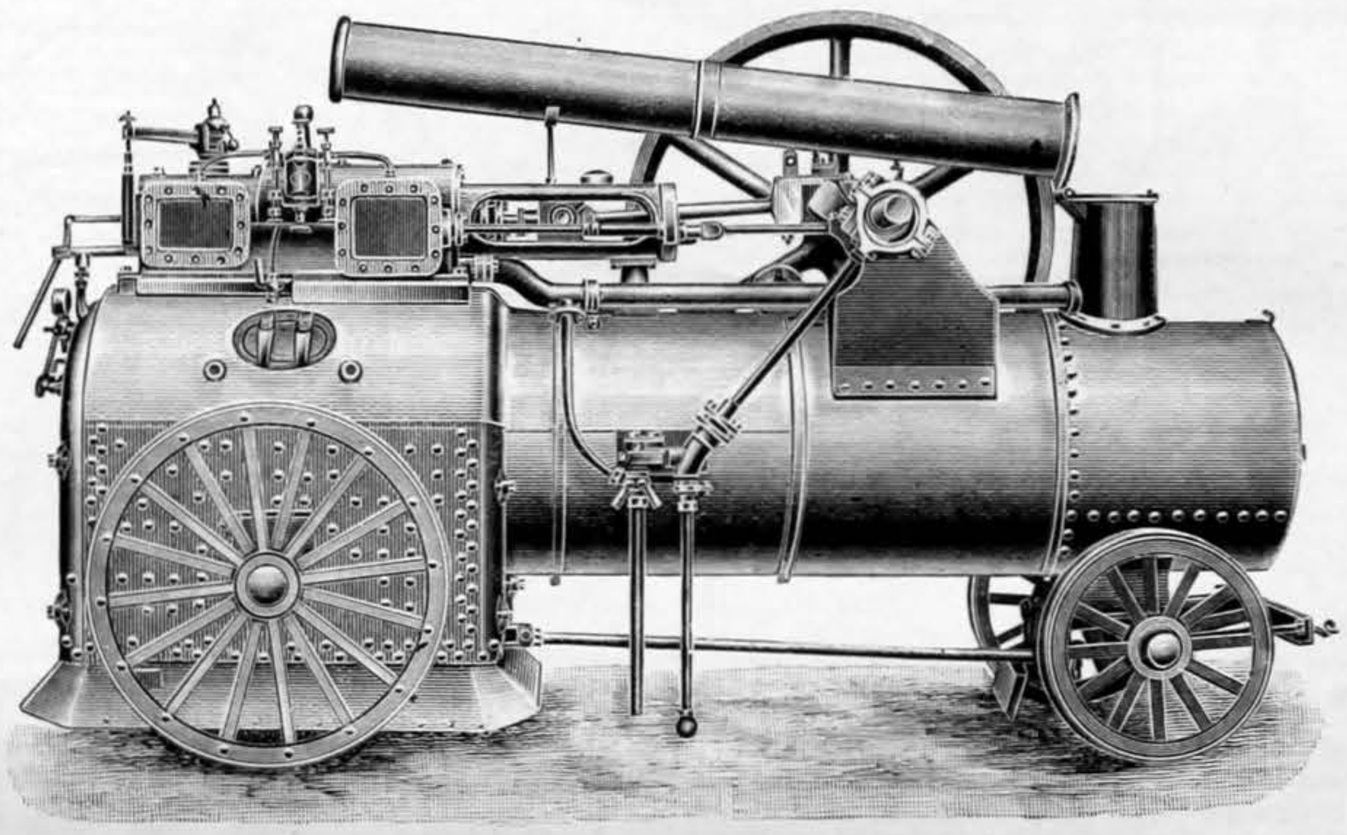


Fig. 4—16-H.P. COMPOUND PORTABLE ENGINE, HUNGARIAN STATE WORKS

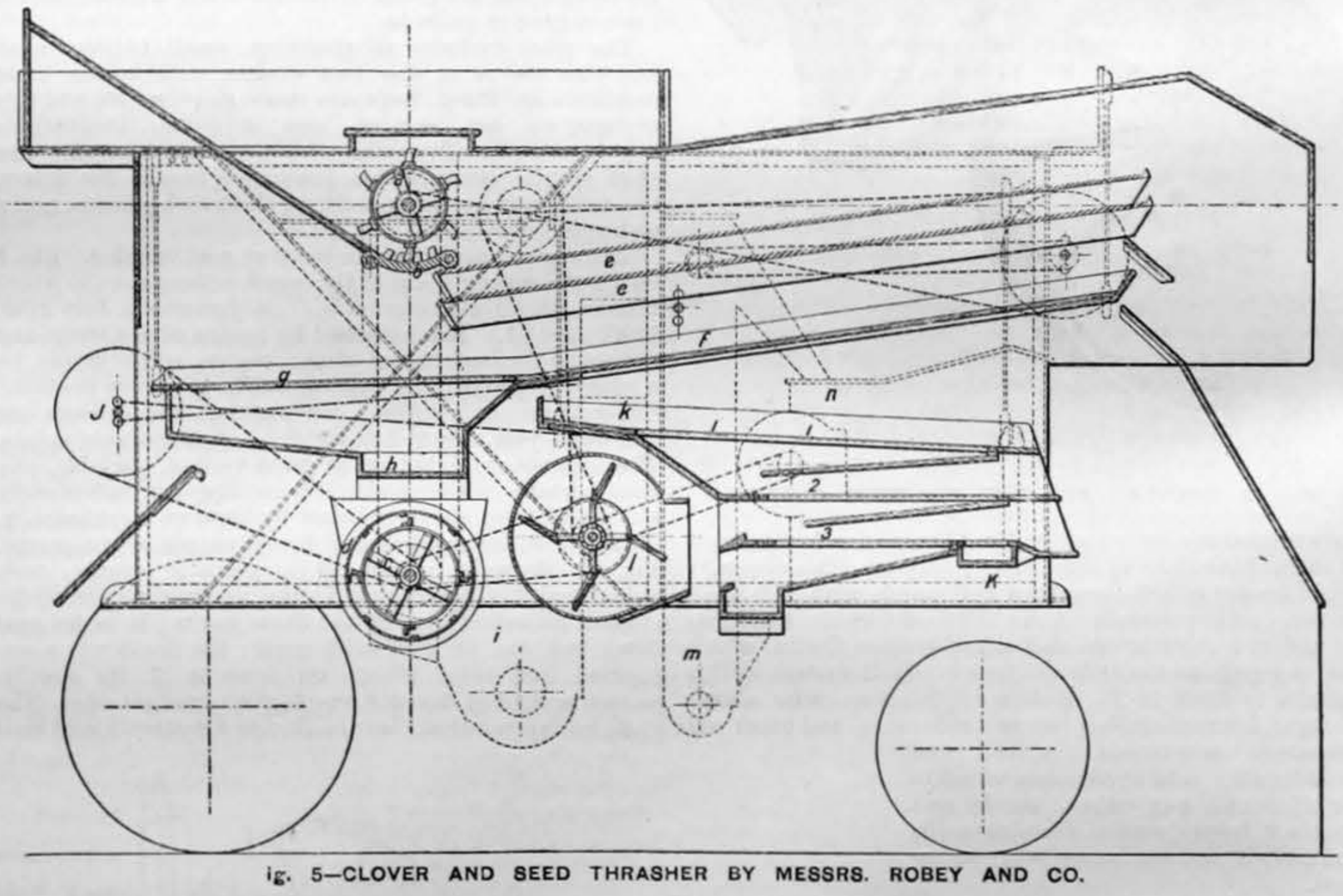


Fig. 5—CLOVER AND SEED THRASHER BY MESSRS. ROBEY AND CO.

	Imports.		Exports.	
	Tons.	Pounds Sterling	Tons.	Pounds Sterling
Locomotives, tenders, portable engines, motors, and hydraulic motors	3,398	175,862	523	23,233
Electric motors	105	4,392	148	6,175
Sewing machines and parts	1,670	167,050	114	12,892
Steam, horse, and hand threshing machines	3,490	118,529	485	16,475
Harvesters	234	15,607	16	1,060
Sowing machines	767	43,183	33	1,795
Ploughs and parts, steam ploughs	2,915	121,233	680	25,862
Other agricultural machines	2,080	78,974	214	8,283
Looms	96	4,790	3	150
Pumps and fire engines	344	15,642	67	3,714
Book-printing and binding machines	170	13,056	51	3,572
Presses	160	6,011	9	329
Hand mills	108	4,508	115	6,714
Cranes	117	3,890	6½	217
Wood-working and metal-working machine tools	861	43,045	79	3,965
Other machine tools	693	34,660	192	9,600
Parts of machines	21,207	795,278	4077	169,954
Vine cultivation machines	59½	2,479	19	1,120
Scales	393½	32,792	54	4,932
Torpedoes	—	—	150	125,000

The total value of the imports amounts to £1,717,656, and of the exports £439,470, leaving a large margin in

favour of the imports, confirming the view that I have already expressed, namely, that Hungary still is a great consumer of the produce of foreign machinery shops, and furnishes a market for good things.

In fact, during the last ten years the imports in the machinery industry have doubled, for in 1884 they amounted only to 10 million florins, now to over 20 million, but at the same time the exports have increased considerably from 3⅜ million florins to 5½ million.

Turning now to the other section of Group IX., it is interesting to note that there are over a dozen exhibitors of weighing machines, and about thirty clock, watch, &c., exhibitors, the rest being scientific and optical apparatus, electrical objects, and such like. The watch and clock industry is of considerable importance, giving employment to 1266 masters with 783 assistants, whilst the amount of material imported under this head amounts to 346 tons, of a value of £211,369, including 28⅓ tons of watches, of a value of £176,350, whilst the exports amount to 19 tons, worth £31,333, 3⅓ tons being watches, worth £29,567. The weighing machine industry came into existence in Hungary with the custom of weighing wheat, and dates back to 1852, when C. Schember and Sons started; they now employ fifty people and 10-horse power in steam engines. They export to the Balkan States and hold various patents, and make a show of all sorts of weighing machines, from weighbridges to chemical balances. The next firm chronologically considered, and which makes a good show, is that of G. Fuchs, dating from 1875; seventy to ninety workpeople are employed, and the machine tools require 14-horse power mechanical. The last considerable firm, chronologically considered, but by no means the least from the significance of its exhibit or workmanship, is Fairbanks Company, established in 1883, employing 110 to 140 people, and 45-horse power in steam engines, shows weighing machines; but its objects are not restricted to those alone. Anyway, these three firms make a computed turnover of from about £33,000 to £43,000 annually. In astronomical, scientific, surgical, electrical, optical, photographic, telegraphic, telephonic, &c., instruments, and in barometers, the imports exceed considerably the exports, although from the Exhibition one may see that there is also a home supply of these things, but of course it is small; in fact, in this particular direction, in only one branch does the export bear any tangible relationship to the import trade, and that is in electric lamps with 56½ tons of imports and 43½ tons of exports. It must, however, be remembered that these are all new to Hungary, and have only been called into requisition since the development of industries has rendered a home supply of scientific implements necessary. Watchmaking, however, is quite an old Hungarian industry; but as may be gathered from the fact that there are so many masters and so few helpers, the Hungarian watchmaking is still only a handicraft, and so cannot enter into competition with countries making watches by machinery.

THE FRENCH MOTOR CARRIAGE RACE.

So far as it has gone the mechanical carriage race now in progress from Paris to Marseilles and back has afforded a good deal of conflicting evidence as to the capabilities of the new vehicles. Taking the results of the first half of the journey, without any reference to the various incidents on the route, the trials cannot be said to be altogether satisfactory. Only eleven carriages out of thirty-two were able to reach Marseilles, and in face of this somewhat meagre result, it may well be doubted whether the self-propelled vehicle has accomplished all that was expected of it. But there are certain features of the contest that may probably tend to modify this unfavourable impression. In the first place, the competition organised by the Automobile Club of France was a race pure and simple; it was intended to test the speed of the vehicles without taking into account the more solid qualities of economy, safety, and ease of handling, which are so essential to the self-propelled carriage. It was precisely for this reason that certain makers objected to the conditions of the trials, while others sought to draw the greatest profit from them by constructing vehicles specially for the race with very powerful motors.

As speed was everything, the competitors were little disposed to exercise caution, and it is evident that an average rate of travelling of twenty miles an hour—which was accomplished the first day—cannot be kept up on the high roads without running serious risk of accident. Then on the second and third days, the weather was the worst that could have possibly been imagined for such a contest. A terrific gale blocked up the roads with trees and telegraph poles, and the accidents resulting from these obstructions, and the clogging-up of exposed machinery by the mud, thinned out the ranks of the competitors considerably. It is thus hardly fair to accept the result as proving the inefficiency of all the vehicles which thus came to grief, as it is pretty certain that under less exceptional conditions some at least would have accomplished a creditable performance. Nevertheless, the race has shown up a great many defects in the present types of mechanical carriages, and has again proved, if proof were needed, that a carriage is not suited for every condition of running, unless the mechanism be thoroughly protected and raised well up out of the mud and dust.

The deplorable weather early in the contest is much to be regretted, because it has deprived the trials of much of their technical interest. The race promised to resolve itself into a struggle between the old types of vehicles and the new, that is to say, the perfected vertical motor and the horizontal engines with their improved gearing, which have been designed upon lines suggested by the previous trials. Of the former, the chief representatives were Panhard and Levassor, who had entered four vehicles propelled by a powerful type of Daimler motor, while the new carriages were run by Peugeot and Company, who had abandoned the Daimler for a horizontal motor of their own invention; MM. Léon and Amedée Bollée, the former with his light tandem vehicles driven from the rear wheel by a horizontal motor, and the latter with a four-seated carriage propelled by a horizontal motor, and bevel-geared to the rear driving wheel, and M. Emile Mors, who likewise had a horizontal motor of his own invention. Apart from these carriages there was little of special interest in the vehicles that assembled on Thursday, September 24th, on the Place de l'Arc deTriomphe, preparatory to the run to Versailles, where the start was to be made.

After the usual police formalities had been gone through, the carriages started for Versailles in the presence of a large crowd of spectators. Most of the vehicles ascended the long and steep gradient at Suresnes in a satisfactory manner, though several of them had to stop a few minutes to effect slight repairs. A Bollée vehicle and another were stranded on the way, and had not reached Versailles when the starting signal was given. The Dion steam tractor, driven by Count de Dion himself, created an impression by dashing up the gradients at full speed, leaving a good deal of vapour in his wake; but it is difficult to see how this compromise between a traction engine and a locomotive can come under the category of self-propelled carriages, or that it is suited for any other purpose than that for which traction engines are usually employed. The light Bollée vehicles and the petroleum tricycles which had failed so conspicuously the previous Sunday in the bad weather, showed that they were capable of performing very satisfactorily under better conditions; but, as will be seen further on, the Bollée vehicles again succumbed when the storms had made the roads heavy and muddy.

There were several thousands of spectators on the Place d'Armes at Versailles to see the vehicles start on their long journey to Marseilles and back. The first day's stage was at Auxerre, where the vehicles had to put up for the night under official observation, to prevent any repairs being effected. In fact, competitors had to carry out all their repairs on the road; and once the carriages were entered as having completed the day's journey, they were not allowed to be touched. The same rule was rigidly observed at the following stages: at Dijon, Lyons, Avignon, and Marseilles; and the times each day between the start and the entering of the yard was added up to give the time for the full distance of 1700 kiloms. After seals had been attached to various parts of the vehicles at Versailles, they were sent on their way by Count Henry de la Valette.

Some delay was caused by the first vehicle, belonging to M. Fisson, running over a man, but when it was found that his injuries were not serious, the others were despatched at intervals of a minute. Altogether, there were thirty-two vehicles, belonging to the following makers:—M. Fisson, of Paris; M. De la Haye, of Tours; the Maison Parisienne des Voitures Automobiles, Panhard and Levassor, Peugot et Cie., Count De Dion, Amedée Boilée, of Le Mans; Lebrun, of Paris; Landry and Beyroux, of Paris; Rossell, of Lille; Triouleyre, of Paris; Léon Bollée, of Le Mans; Rochet and Schneider, of Lyons; Tissandier, of Paris; and Tenting, of Paris. There were twenty-seven petroleum carriages, including the light Bollée tandem vehicles, three steam vehicles, and five petroleum tricycles. All three of the steam vehicles were propelled by the Dion system of generator, and in view of the almost entire abandonment of this power by the French mechanical carriage users, the small proportion of steam vehicles in the race is not surprising.

Hardly had the last vehicle been sent on its way than news arrived that the No. 5 Panhard and Levassor carriage, with which the firm expected to win the race, had been stopped through the rubber tire slipping off one of the wheels, and about an hour was lost in effecting repairs. At first it looked as if the first day's stage would be an easy victory for the Dion steam tractor, for this vehicle travelled at a remarkable rate until a little beyond Melun, when it was stopped through the pneumatic tires puncturing. Considering the weight of the vehicle, the idea of employing air tires was peculiar, to say the least, and they were damaged to such an extent that there was no possible hope of repairing them. Count de Dion had therefore to give up the struggle, and it was only after infinite trouble that he succeeded in getting the cumbrous machine to the nearest town. The other steam carriage, driven by Count de Chasseloup-Laubat, also came to grief through a defect in the mechanism, and several hours were spent in taking it to pieces and endeavouring to put it together again. Not one of the steam vehicles was able to cover the first day's stage. This is somewhat unfortunate, as it tends to throw more discredit upon steam than is warranted. The vehicle to arrive first at Auxerre was the tandem machine driven by M. Léon Bollée, which had covered the 178 kiloms. in the excellent time of 5 h. 31 min. A Dion tricycle followed twenty minutes afterwards, and then came another Bollée, with Delahaye, Panhard, and Levassor, and another Dion tricycle in that order, the others being a long way behind.

The Peugeot carriages were delayed several times by the extinction of the burners, which caused the competitors considerable inconvenience, and, in fact, few of the vehicles were found to be entirely free from constructional defects. Altogether twenty-seven vehicles reached Auxerre, some of them arriving during the night. The following morning a violent gale afforded a very unpromising outlook for the competitors, and, with reports coming in that the roads were blocked up by fallen trees, it was proposed at first to abandon the contest. To this, however, the competitors would not agree, and the vehicles were sent off in the order in which they had arrived the previous day. Very soon the soft and muddy roads told upon the low-down Bollée vehicles, which were obliged to stop through the mechanism becoming clogged up and deranged by the mud. M. Léon Bollée, who had won so easily on the first stage, has made a complaint to the committee to the effect that during the night someone had surreptitiously introduced emery powder into the bearings of his motor. Whether this was so or not, it is a fact that the piston and some of the parts were literally ground away. Then the carriage of M. Amedée Bollée crashed into a tree that lay across the road, and the four passengers were thrown a distance of 20 yards, though fortunately sustaining no serious injury. The carriage itself was smashed to pieces. The Rossel carriage came to an even less inglorious end. It was being pushed up a gradient by the passengers, when, on arriving at the top, the gale of wind blew it backwards, and the passengers helplessly watched it go to its destruction in a collision with a tree. In fact, the trees were a constant source of annoyance and danger to the competitors. Some of the vehicles were driven into the fields in order to get round the obstructions, and M. Delahaye lost a couple of hours in cutting a way for his carriage through a fallen trunk. This was indeed a disastrous day for the mechanical vehicles, and of the twenty-seven that left Auxerre in the morning sixteen only were able to reach Dijon, some of them several hours behind the first arrivals. The first four places were taken by Panhard and Levassor, of which the first covered the 151 kiloms. in 6 h. 39 min. From Dijon to Lyons the conditions were scarcely less favourable, for the rain still fell heavily, accompanied by a strong wind. On this stage likewise a few accidents took place, one of them of a serious character. The No. 7 Panhard carriage tried to avoid a wagon when passing through Villefranche, and in so doing ran on to the pavement, when the vehicle overturned. Three of the passengers escaped with a severe shaking, but the fourth was picked up with a broken nose and a wound on the forehead. Happily, it was found that the injuries were less dangerous than had been feared. The carriage was damaged, and apparently was not in a state to continue the race.

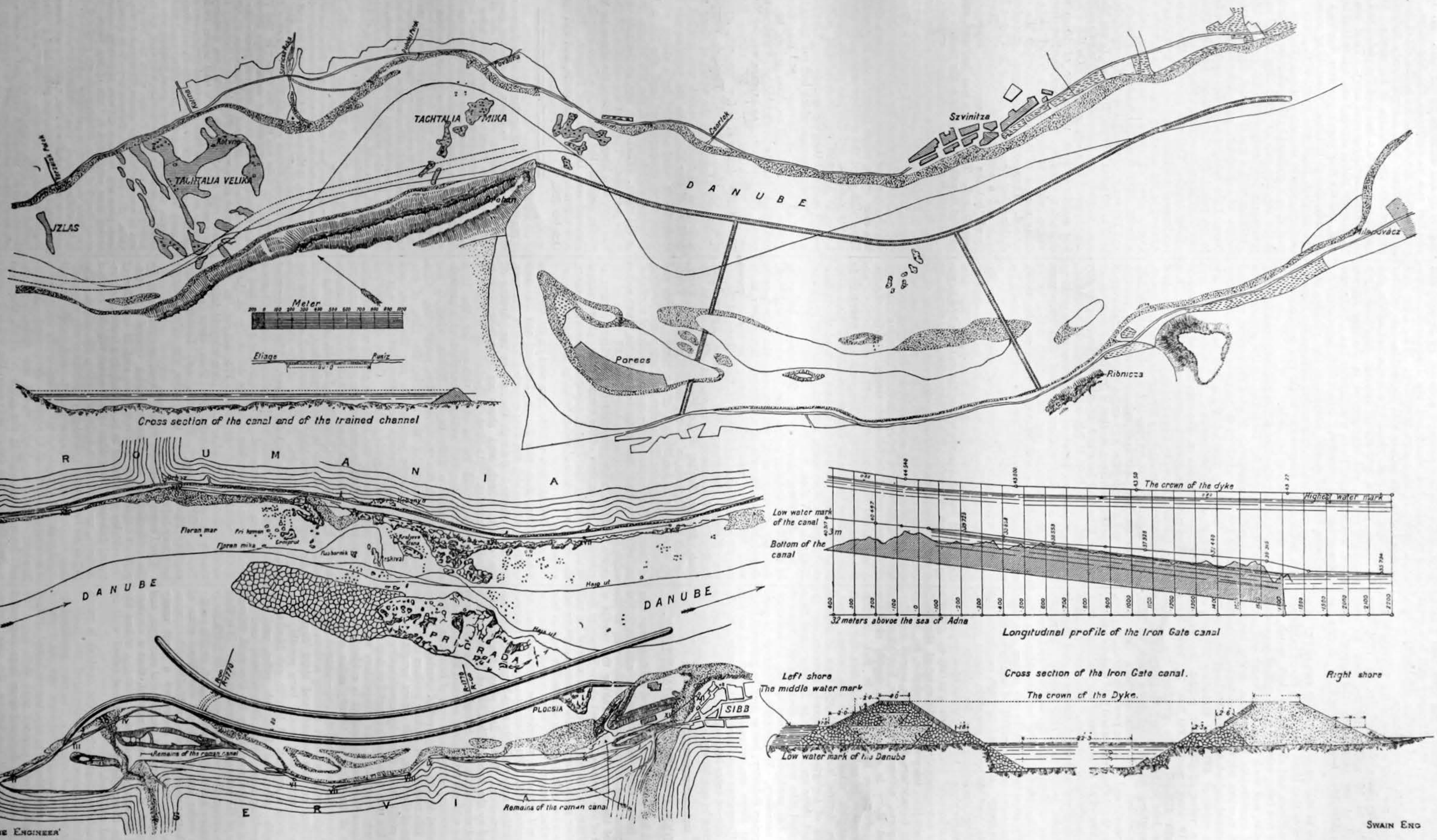
Notwithstanding the unfortunate weather, the leading vehicles accomplished a very good performance, and the No. 6 Panhard and Levassor carriage covered the 198 kiloms, between Dijon and Lyons in 6 h. 29 min., followed half an hour afterwards by a Peugeot vehicle. Fourteen vehicles reached Lyons, and there was a difference of no less than seven hours between the first and last arrivals. From this point the weather was much more favourable to the contest, and the run on the fourth stage from Lyons to Avignon was accomplished with a no more serious accident than the overturning of the No. 5 Panhard and Levassor carriage, which had run into a tree in trying to avoid a dog. M. Levassor and his companions were shaken, but sustained no other injury, and the carriage was intact; but it was decided, nevertheless, to give up the race. The first arrival at Avignon was the No. 46 Peugeot carriage, which had run the 227 kiloms. from Lyons in 7 h. 48 min., followed a few minutes afterwards by a couple of Dion tricycles. Thirteen competitors completed this stage, and the whole of them subsequently arrived at Marseilles, which was reached without any incident of any kind. As the weather was fine, and the competitors were assisted by a strong wind, very fast times were accomplished, and the No. 6 Panhard and Levassor vehicle covered the 109 kiloms. in 3 h. 6 min., or 67½ miles. That is to say, at the rate of nearly 21·8 miles per hour. The first ten vehicles did the distance in less than four hours. Adding the times for the first half of the distance, the leader is a Dion tricycle, followed by Panhard and Levassor and Peugeot. The vehicles are now returning by the same route, and will reach Paris on October 3rd.

THE GERMAN BARB WIRE EXPORT.—The German export trade in barb wire, especially to Japan, is suffering greatly under the pressure of American competition, says one of our German exchanges. The Hamburg exporters are being forced to buy American barb wire, for their foreign customers have commenced to make their purchases in this line directly in the United States, thus evading the Hamburg middleman. Confronted by the alternative either to lose this trade or to buy American barb wire themselves, they decided to take the latter course because they were afraid that the loss of this trade might result in the loss of trade in other lines; for it is a well-known fact that business relations once formed will extend to other articles. All that is left to Hamburg firms is the prospect to sell the article at retail in fifty-coil lots. Matters in the wire nail export are exactly similar. The Americans export wire nails, *vid* Hamburg to Japan, at figures which the German manufacturers cannot meet.

BRITISH AND GERMAN TRADE IN CHILE.—Mr. Hayes Sadler, our Consul-General at Valparaiso, devotes an important section of his report, which has just been issued, to a discussion of the position of the chief manufacturing countries, and especially of Great Britain and Germany, in the trade of Chile during the past ten years. In 1884 the total import trade of the country amounted to £8,373,751, of which Great Britain sent £3,250,334, Germany £1,624,475, and France very little less than the latter; in 1889 the total trade amounted to £10,305,919, of which Great Britain contributed £4,416,220, Germany, £2,341,568, and France less than half this latter amount; in 1894 the total trade was £8,626,573, of which the British share was £4,032,044, that of Germany £1,960,418, and France only a sixth of the imports from Germany. In the ten years ending with 1894, out of a total import trade of nearly 94 millions sterling, the *Times* says Great Britain sent over 40 millions and Germany over 21 millions. While Great Britain is still ahead in many ways and has gained in machinery and some other manufactures, Germany has made great progress also in machinery, furniture, earthenware, chinaware, hardware, and in textile goods, mainly at the expense of France, which has lost ground all round, and in some articles has almost disappeared from the trade of Chile. The increase in German imports is greatly due to their lower price and to more German importing houses than English having been established in Chile of late years. Still, in almost every branch of trade, British goods are preferred at equal prices, and their superiority is generally acknowledged; but price rules in the Chilian market. One hold Great Britain has over the Chilian market in some articles is that, while the metrical system is that established by law in Chile, the people have grown accustomed to English weights and measures. Machinery is always asked for in English sizes; bolts, nuts, gas pipes, &c., are used with English threads, and any innovation would lead to much confusion. Iron and steel plates and bars are sold in English feet and inches, and this applies to lumber and some other articles. On the other hand, the number of Germans in Chile far exceeds that of the British; colonisation south of Conception is almost German.

THE REGULATION OF THE CATARACTS OF THE DANUBE—MAP OF THE IRONGATE ROCKS AND CANAL

(*For description see page* 335)



'THE ENGINEER'

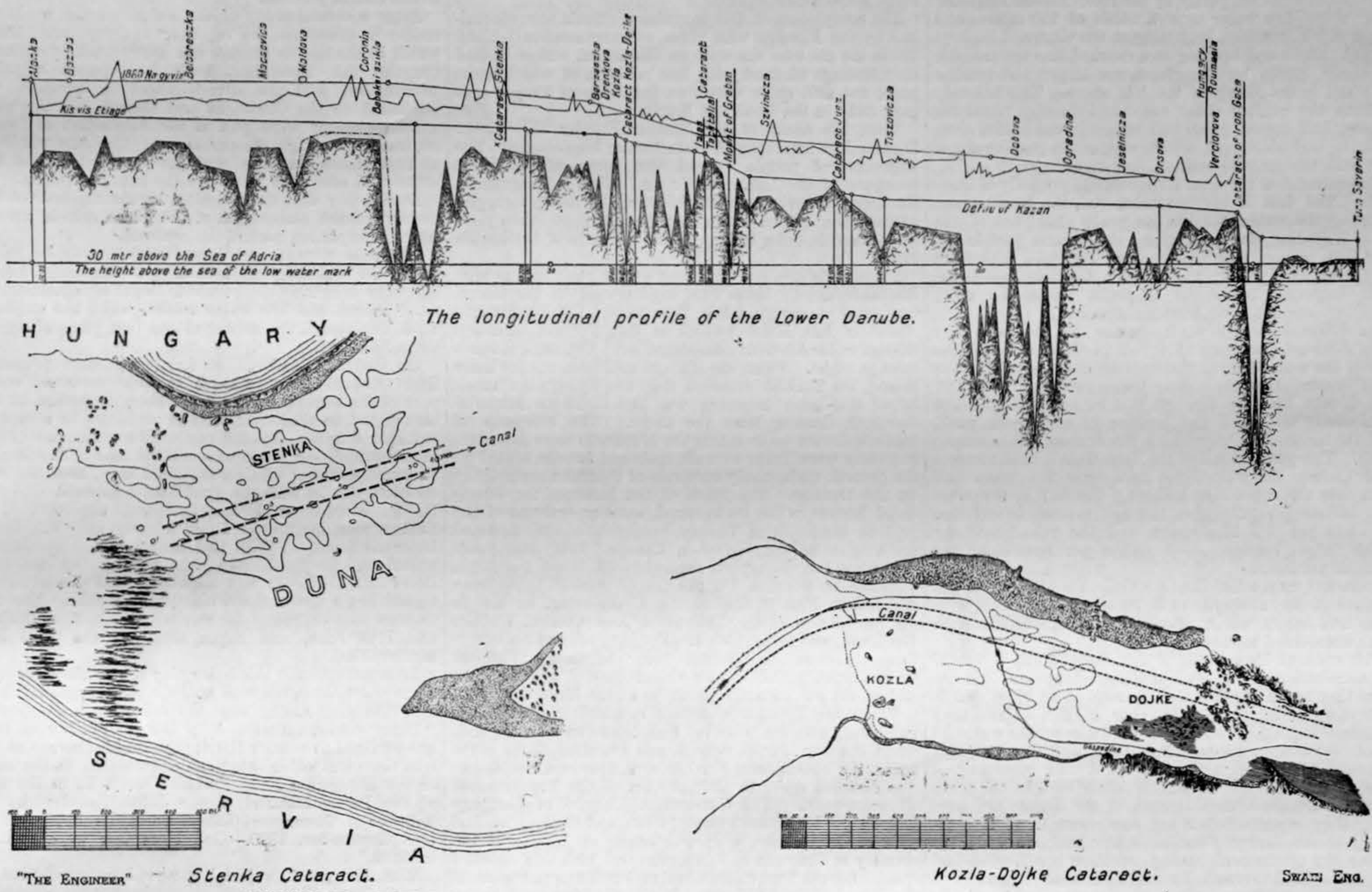
SWAIN ENG

THE IRON GATES OF THE DANUBE.

Commenced nearly two thousand years ago, when Trajan and his armies went on their conquering expeditions, a navigable way has at last been made through the Prigrada rocks which constitute the Iron Gates of the Danube. It is not quite correct to say that Trajan commenced the work now completed from the modified designs of Paul Vazarhelyi, because the Roman canal evaded the great rocks, and made a small waterway sufficient for the boats towed along the river banks of what is now the Servian territory. These canal works are still existing as ruins, which give a good idea of the character of the utilitarian work possible even in the days of two thousand years ago. The canal made it possible to escape the Prigrada channel narrows itself to 400 metres, but soon widens again, and at a distance of 70 kilometres the flow of the water is impeded by the Tzlas; the large and small rock banks of the Tachtalia, and the steep limestone walls of the mount Greben penetrating far into the channel, confine the water, and the effect is aggravated by great rock obstacles with their peaks passing through the main channel. The peak of the Greben narrows the channel of the river to 420 metres, and at a low-water mark, the bank of the Vrany rising opposite this channel, leaves a course of hardly 220 metres to the flow of the water. After passing the Greben, the channel enlarges rapidly to 2 kilometres, forming large and small islands and banks on this plateau.

The cataract of the Tzlas, Tachtália, Greben was, at this cataract, at the lowest water level, reaches 2 metres per kilometre, while the depth of water, principally on the left shore of the channel, is only a few centimetres, so that at such times navigation is stopped. At high water this great cataract fall disappears entirely. This is caused by the straits of the Kazán, in a distance of about 14 and 100 kilometres from Báziás, which raises the surface of the water to such a degree that the cataract of Jucz is submerged, the flood water reacting at a great distance up stream, and equalising the great fall, so that the cataract of the Jucz forms a navigation hindrance only at low water.

Leaving the cataract Jucz, situated in the most southern part of Hungary, and descending 14 kilometres from it, a part is reached where the channel of the Danube is con-



The longitudinal profile of the Lower Danube.

LONGITUDINAL SECTION OF THE DANUBE FROM TURN SEVERIN TO BAZIAS—AND PLANS OF CATARACTS

cataracts. It commenced at the village of Sibb and was two miles in length. It formed part of the great monumental works constructed first under Tiberius and completed under Trajan, consisting of a riverside road and tow-path, much of which was constructed through very hard rock. The whole of the works and the history connected with the now nearly completed improvement of the Danube as a navigable way, by the removal of the rocks and peaks in the bed, and by regulating the flow at parts which have hitherto been dangerous cataracts, were fully described in our columns in articles by Mr. Bela von Gonda, Hungarian technical minister of inland communications, so that we need not here enter at length into the details of the work.[1] On page 342 we reproduce some of the engravings, showing the positions of the rocks in the waterway, and of the new and old training walls and canal cuttings. The engravings include a plan of the river from Verzsisk Potok to Milanovacz, and separate plans of other parts of the river in which the rock obstructions and the canal works are situated. The position of all these will be gathered readily from the section of the whole length concerned, which is given above and acts as a key to the several plans.

The Danube leaves the Hungarian plain at Báziás, and from this point—which, as the terminus of the Temesvár-Báziás Railway, is the centre of the province—begins the Lower Danube proper with a number of cataracts hindering navigation.

Forty-four kilometres from Báziás the first hindrance is met, where the granite rock Gornya-Stenka penetrates with its steep peaks into the channel, forming the first—although unimportant—cataract, the Stenka, rendering the navigation difficult, and also restricting the flow of the river.

At a distance of 17 kilometres from this, the foot of the mountain turns toward the right shore, penetrating the channel in a downward bending direction, and the bank of the Kozla forces the current of the river entirely to the left shore, whence the rocks, with the prominent peaks of the Dojke, pass upward, forming a sharp tongue, and forcing the water in a nearly right-angular direction to the right shore, and narrowing the channel to 380 metres. The double peak of the Kozla-Dojke dams up the surface of the water throughout a length of 1·86 miles, while the water falls proportionately on a short section—about 1 kilometre—above the cataract, the fall being 31·7in.

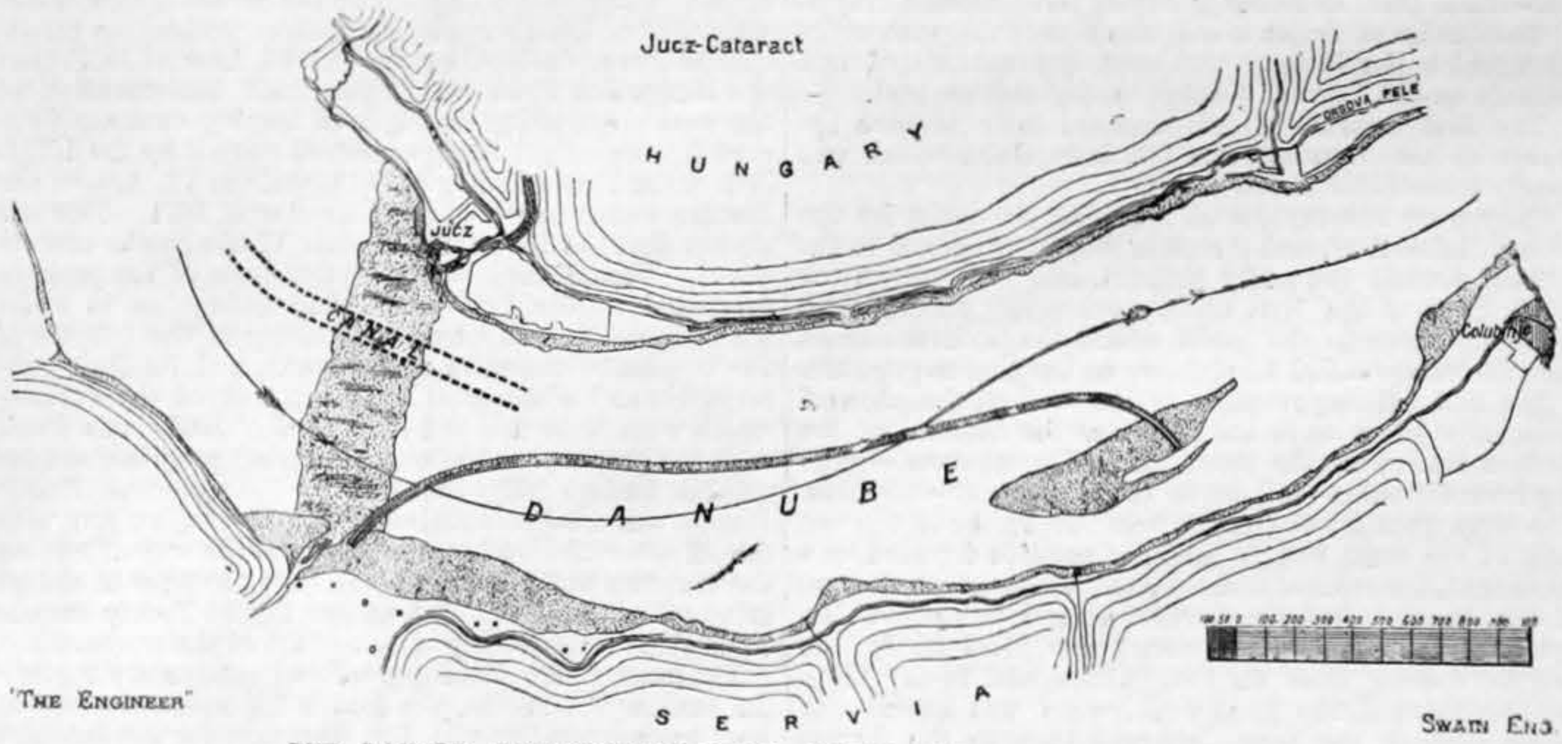
Sixty-nine kilometres from Báziás or Baziasch the whirlpools at the foot of the mountain. Here there is a depth of about 30 metres, caused by the whirl of the water during thousands of years, threatening the boats with destruction when piloted thither by unpractised hands. Naturally it is impossible to navigate this part against the stream at high-water.

Leaving the Greben, there is still a length of 2 kilometres, which has not sufficient depth for navigation. At 11·5 kilometres from the peak of the Greben the high bank of serpentine passes through the channel and impedes the free flow of the water forming the cataract called "Jucz." At low-water, the water drops with a great fall over the prominent peaks of this bank, and the fall except the Iron Gate, the largest and most dangerous obstacle to navigation, and not only at low-water mark, when the mariner seeks his way with anxious circumspection between the rocks of the Tzlás and Tachtália, and is bound to struggle with the rapidly changing great falls of the water, which attack the boat constantly from one side and another, and make piloting very difficult; but also at high-water, when the confined water of the channel, narrowed by the peak of the Greben, falls subsequently into the large channel, causing dangerous fined between steep and high rocks, forming the straits of the Kazán, which is the most picturesque part of the Lower Danube.

The Danube runs between steep rocks with a width changing from 170 metres to 380 metres, and a depth from 20 metres to 50 metres, at a length of 4 kilometres, till on the left shore the mountains retire, and in a length of 1½ kilometres the valley of Dubova puts an end to this narrowness. The channel of the river enlarges there to 500 metres, and its depth increases to 10 metres, till the rocky mountains approach again with steep walls reaching as far as the edge of the channel, which narrows again to 180—300 metres. Its depth decreases to 30—54 metres; but the river again loses at Ogredena, a distance of 9 kilometres, this restriction of its boundaries.

The straits of Kázán, although at high water they cause a considerable raising up of the water surface, do not form a hindrance, because, besides its great depth, the fall at the lowest water is only 36 centimetres per kilometre.

Coming out from the straits of the Kázán, the river turns towards the east, the mountains retire on the left



THE DANUBE IMPROVEMENT CANAL WORKS—JUCZ CATARACT CANAL

[1] The Engineer, vol. lxxviii., pp. 32, 34, 378, 463, 542; vol. lxxvii., pp. 326, 332, 472, 473, 474, 496, 502.

shore, and the channel of the river enlarges to 400—600 metres. At 10 kilometres from the Kázán, on the right shore, is Tekia, a Servian town, opposite Orsova on the left shore, at the foot of the mountain forming the border between Hungary and the Lower Danube.

At a distance of 8 kilometres from Orsova, and 128 kilometres from Báziás, the "Iron Gate" begins—see engravings of plans and sections pages 334 and 335. It is situated between Roumania and Servia, and is, for a length of 3 kilometres, the largest and most dangerous obstacle on the Lower Danube. The rocks, which pass through the channel, impede the current, and begin at the foot of the mountain called Alion, at 122 kilometres, and the depth of water rises, at lowest water, from 7—18 to 2—6 metres, and this rock-bank extends in length 8 kilometres, but forms a real cataract only in the part of 128—130 kilometres, partly by the rocks named Prigrada, rising above low water over a width of 250 metres and length of 2 kilometres, beginning at the village of Sibb on the right shore and bending in a crooked line towards the left shore, partly by the numerous larger and smaller rocks and peaks rising on the left shore. This not only slackens the current of the water and thereby raises the surface, but causes great and irregular waterfalls, cross currents, and whirlpools, which expose the passing ships, even with the greatest caution, to danger.

The cataract of the Iron Gate consists properly of three parts. The first is the entrance, viz., the bank, which dams up the water, but has no peaks rising out of the water impeding the navigation; the second part is the Iron Gate proper, with the rock of Prigrada, with most dangerous rock peaks; and, finally, the third part, the great deepening below the Prigrada, where the water in falling over the rocks form whirlpools.

At different heights of the water the navigable way takes different directions at the Iron Gate, in which the flow of the water follows through the most equal and the most favourable path among these peaks. The sailor who directs his ship through this cataract, must know particularly the place and position of every rock, peak, and the serpentine way which the current takes among them. The greatest fall at the Iron Gate is at the lowest water, when the water-level falls over the rocks and flows into the succeeding hollows; this fall in the river is 3 metres per kilometre, through the whole cataract 5 metres per 2·5 kilometres, and the velocity of the water ranges between 4—5 metres per second, or say 10 miles per hour.

After the cataract of the Iron Gate, the channel of the Danube is for a length of 6 kilometres crowded with rocks and banks, which afterwards cease, and the river flows untroubled towards the sea.

The eminent importance of the Danube—as a way of communication — was well understood by the Romans when they made use of it with success as an expedient in their conquering wars. In view of this object they executed important works on the Danube, the ruins of which even now excite admiration, showing us great technical knowledge and evidence of vast command of labour. Besides the numerous stone bridges, the parts of which are the admirable work of the Latine architecture, they constructed along the river, from Regensbourg to the Lower Danube, a tow path, in order to assure the unhindered haulage of their boats. We find numerous and remarkable monumental remains of hydraulic engineering and improvements, works of the Roman reign on the Lower Danube; these ruins speak to-day of the intellectual and material power of these conquerors of the world, who found their way surmounting all obstacles.

At Ergeta castrum, as it was called at the time, in Mosia, downward from Turn Severin, the Roman Emperor Trajan caused to be built a large wooden bridge on stone piers, parts of which are visible, after the plans of Apollodorus Damaskus, in the year 102-103 B.C., that is to say, in the short period of one year, proving the great development of the technical ingenuity of that time. This bridge is commemorated on the triumphal gate constructed in Rome glorifying the Emperor Trajan.

The Bridge of Trajan is only the first of the great works with which the Romans rendered the unhindered free passage on the Lower Danube possible and assured.

The first cataract, which hindered their advance upwards on the Danube, was the Iron Gate, which was nearly inaccessible at low water.

They were not capable of removing the rocks by the means of that time, and therefore they were obliged to cut a canal around the rocky channel, and to begin on the right shore of the Iron Gate, constructing a canal with gigantic labour to the point where the cataract ends, near the village called Sibb, shown on the plan on page 334.

The still existing remains of the wall of the channel show how great were the forces at the disposal of the Roman leaders of the time. This Roman canal—judging from the ruins—led on to the right shore—see plan. The large quantity of detritus from the brooks at the two ends of the canal was as much as possible diverted by a stone wall, the ruins of which are still visible in the channel of the brook. But time removed and destroyed the dykes of the canal, its channel was filled up by the detritus coming from the two valleys, and to-day there are only ruins of the great work, which was intended to break through the Iron Gate and to open the Lower Danube to unhindered navigation. But how justly the Romans understood the question of the regulation of the Iron Gate, is proved by the fact that modern engineering, with all its numerous expedients, proceeds on the Roman lines in avoiding the cataract by cutting a canal on the right shore.

At the other cataracts we find no traces of Roman attempts to surmount the hindrances by any works. But this was not as necessary as at the Iron Gate, the other cataracts being navigable with boats of a small draught, and the difficulties existed only in the haulage. To make the haulage of the ships possible, the Roman and Macedonian legions of the Emperor Trajan accomplished the great and admirable work to which we have referred along the Lower Danube. This is the Way of Trajan along the right shore of the river. From the remains of this work, which are still visible, some of which are shown at page 342, may be judged how great were the forces at command, and what immense work this road required. At places where the channel of the river is walled with rocks of immense height, the road is cut into the rocky walls, in some places in the form of a screen, but as they were not able to remove the rocks and to construct the whole road in this manner, they built a part of it on beams let into the rock wall and forming a cantilever roadway, as can be seen even to-day from the remains.

The Way of Trajan was begun by the Emperor Tiberius, and the Emperor Trajan continued and finished it in A.D. 103 with the aid of the Fourth Scythian and the Fifth Macedonian legions.

The completion of this magnificent work was eternalised by the Romans with three commemorative tablets. These are cut into the wall on the shore, within incised surroundings adorned with fine relievos, of which some parts are still quite visible on the Table of Trajan—see page 342—in the Straits of Kazán.

With the decay of the Roman Empire the Lower Danube lost for a long time its former importance. The migration of people caused the decay of the great creations of the Latin races: and after long centuries the Lower Danube became the scene of heavy struggles against the Turks, and many fortifications have been built there in order to impede the advance of the hostile army.

These forts are, however, now of the past, as was seen the other day by those who were present at the formal inaugural ceremony, when they passed the picturesque island of Ada Kaleh, which is still Turkish territory, though under Austrian administration. On board it was a strange sight. From the Mosque and from a point more inland, the Turkish crescent flag was flying; but much larger and more imposing was the Austrian Imperial standard floating from the shore. The company of soldiers drawn up to salute the Monarchs were Austrian, but there were Turks as well, male and female, seated on the ground, melancholy survivals of Ottoman sovereignty on the Danube. The ruins of the fortress, the dilapidated houses in the background, were an epitome of the present condition of Turkey, hemmed in, and destined ere long to be supplanted in Europe. Sixty-two years ago, when Count Stephen Szecsenyi, on board the Argo, ventured on the first Danube trip of modern times from the Kazan Pass to the mouth of the river, he had to ask permission of the Pachas of New Orsova, Widdin, Rustchuk, and other places. For long afterwards everything visible on the Danube below Orsova was Turkish. On the right bank it is now either Servian or Bulgarian, and on the left Roumanian, as far as the Black Sea.

When the Turks were finally repulsed to the Balkan peninsula, and the reign of Napoleon came to an end, when the war alarms ceased, and peaceful times came again, the attention of the Governments and Statesmen was directed again to the question of the improvement of waterways. The Government Council of Hungary defined in 1816 the topographical and hydrographical plan of the Danube, with reference to the frontier of the country to Csernecz in Roumania, and with this object a special bureau was established under the supervision of the Board of Public Works. But the surveys were begun only in 1823, and finished in 1838. These surveys embraced the study of all circumstances referring to the channel of the river and the current, and were executed so precisely and conscientiously, that they are still now the pride of the Hungarian hydrotechnics. On the basis of these surveys particular plans were elaborated for the uniform regulation of the Danube; but these plans were not carried out.

With a view to these regulation works for rendering the cataracts of the Lower Danube navigable, the Hungarian Government, through Gabriel Baross, the Minister of Public Works and Communications of that time, presented in 1888 to the Legislature the general projects and estimates of the necessary regulation works. In consequence it was decided by the XXVI. Law of 1888, that the Hungarian State takes upon itself the execution of the works, exercising the right of levying customs temporarily, such right being conferred upon it by the LVII. Art. of the Berlin Treaty of 1878, and the VI. Art. of the London treaty executed the 13th March, 1871. The law states, that the Minister of Public Works has to execute the above-mentioned works on the basis of the projects presented to the Legislature, and undertakes to make such dispositions as may be necessary in the interest of the successful execution of the works, and for their conservation and administration. The cost of the works—which were to be finished at the end of 1895—was fixed, with the proportions to be paid during progress, at nine million florins. By the law the Minister of Public Works was further entitled to fix, in conjunction with the Minister of Finance, the time and the way of levying the customs which Hungary will have the right to charge in virtue of the LVII. Art. of the Berlin Treaty on the trade ships for covering the expenses of the works.

The largest part of the regulation works extending into the territory of Servia, the first thing necessary was to arrange between the two Governments for the free and uninterrupted movement of men and materials. As soon as this was done, the Minister of Commerce organised a technical bureau for surveying and controlling the execution of the works. This bureau had its seat in Orsova, and was constituted in the following manner:—Chief of the Bureau, Ernest Wallandt, ministerial councillor; assistant, Alois Hoszpotzky, chief engineer; members: Ernest Jzsaky, ministerial engineer; Eugène Gruber, and George Kherndl, royal engineers. Later the minister delegated Francis Herbert captain of engineers.

The so organised technical bureau had at first to elaborate the particular plans, and to study the hydrographical condition of the section which was to be regulated. At the same time the minister made dispositions as to the modus and means to be employed in the most difficult part of the work, viz., the blasting of the rock under the water in the open river. He proposed to give a prize for explosive material to blow up the rocks under the water, and for the best systems with which the removal of the rocks under the water could be executed with success. The offers presented were put before a special commission, which examined the explosives and made several experiments on the spot. Moreover, the minister sent Mr. Béla Gonda—technical councillor and reporter of the Iron Gate works on behalf of the ministry—and Mr. Alois Hoszpotzky—chief engineer and assistant of the technical bureau—to Bingerloch in order to study the works of blasting which were in execution. The result of this was a report, which contributed much to settle the lines on which the practical execution of the works should proceed.

After a careful study of the nature of the works and modes of execution, the minister was convinced that it would be the best to execute this heavy work by contract. On the 5th December, 1889, he opened a public competition, and the advertisement in question was published on the Continent and abroad, and the plans and stipulations were put at the disposition of foreign contractors through the embassies. The date was fitted at 31st March, 1890, so that the competitors had four months to study the plans and the local conditions.

During this time the technical bureau finished the new survey and the elaboration of the plans, which were to form a completing part of the contract.

Moreover a great and difficult task was to be solved before the beginning of the work; the technical bureau had to re-determine on the whole length of regulation, the fixed points, and low-water marks, which the engineer, Paul Vásárhelyi, the author of the first plans of regulations, had fixed.

On the 31st March, 1890, four contractors presented their tenders. Two of these tenders concerned only a part of the works, and the two others demanded exorbitant prices, so that their tenders could not be accepted; but after long negotiations, one of the syndicates offered to accomplish the proposed works for nine million florins. In consequence of this, on the 22nd May, 1890, the final contract was let with the syndicate composed of Julius Hajdu, Hungarian hydro-technical engineer; Hugo Luther, manufacturer at Braunschweig, and the Berlin Discount Society. With this contract these contractors undertook to finish the whole work by the 31st December, 1895. It was stipulated that the syndicate should begin the works within two months. The contractors took charge of the works on the spot on the 16th and 17th June, and began them on the 18th September, 1890.

To commemorate this latter day the contractors cut a memorial table in the rock wall on the Hungarian shore, over the rock Alibeg, with the following inscription:—"These works, sanctioned by the XXVI. law of 1888, and destined to remove the navigation hindrances at the Iron Gate and other cataracts, were begun in the reign of the Hungarian King, Francis Joseph I., in the time of the Prime Minister, Count Julius Szapàry, by the Minister of Commerce, Gabriel Baross de Bellus, on the 15th September, 1890.—God bless this work and its creators."

Well, the great project has now been completed, at least so far as all the formidable operations are concerned, and the Iron Gates Canal was formally inaugurated on Sunday morning last by the Emperor Francis Joseph, who traversed its entire length in company with King Charles of Roumania and King Alexander of Servia. The approaches to the Canal on either side are, however, not yet excavated from the rock, to allow passage at low water. Not until the spring of 1899 will vessels be able to come up from the Black Sea without hindrance, and by that time also the harbour at Orsova for reloading will be completed. It was, indeed, only owing to the fact that the Danube is higher this autumn than it has been since 1860 that Sunday's ceremony was possible at all.

In a year or year and a-half the whole of the works will, it is expected, have been carried out, and by that time 18,600,000 florins will have been spent, according to the estimates, for the regulation of the Lower Danube between Old Moldova and Turn-Severin. Steamers drawing 4 metres, or 13·14ft., coming from the Black Sea, *viâ* Braila or Galatz, will then be able to go up the river without any hindrance to Orsova, where the cargo can be transferred to the railway; or, if drawing only 3 metres, still further up, to Buda-Pesth and Vienna. For the present only the passage from the Lower Danube up to Orsova, and *vice versâ*, will be independent of the season. The canal walls and dams being made of such material, destruction, or even damaging, by high water or floods, is impossible, and vessels which draw 13·14ft. —namely 4 metres—will be able to pass all the year round. The canal is 80 metres, or 262·4ft. wide at the bottom, against the 27 metres of the Suez Canal, and the 32 of the Emperor William Canal. The Iron Gate Canal alone cost 5½ million florins, or more than the fourth part of the entire cost of one of the whole works. One million kilogrammes, or 1000 tons, of dynamite were required for blasting the rocks, and between 3000 and 5000 hands were continually employed. Hungary is proud of this gigantic work, and may well be, for its value in trade and commerce, and in international intercourse, will be great indeed. We regret the death of M. Gabriel Baross, the Hungarian Minister of Commerce, who, as above mentioned, had so much to do with this work, but we congratulate M. Bela von Gonda and M. Ernst von Wallandt on the well-earned honours which were a few days ago bestowed upon them.

Society of Engineers.—Arrangements have been made for the members and associates of the Society, and their friends, to visit the Westinghouse Brake Co.'s Works, King's Cross, and the Midland Railway Co.'s Somers Town Goods Depôt, on Tuesday, the 13th October.

H.M.S. FIRST-CLASS CRUISER POWERFUL.

As the heavy ironclads which had been added to the Navy just previous to the submission of the Naval Programme of 1889 to Parliament were a class of ships quite incapable of defending our commerce of the country or of saving us from depredations at sea, it was decided after much discussion that what was wanted for the purpose was swift and powerful vessels capable of keeping the sea, of convoying a fleet of merchant ships, and of making rapid passages to distant parts without recoaling. Of such vessels, the programme referred to proposed to build several, to be henceforth known as "protected cruisers." Many such vessels, ranging from 3000 to 8000 tons displacement, have already been constructed, and added to our Navy, all of them built from the designs of Sir W. H. White Chief Naval Constructor. On the completion of the vessels of this type ordered in 1889, it was considered advisable by the naval administration of the country, in view of any possible naval conflict with a foreign Power, that more ships of this class should be built, but of much greater power and speed and coal endurance.

In the Navy Estimates of 1893-94 provision was made for the construction of two cruisers—the Powerful and the Terrible—which were to be the largest, swiftest, and most powerful vessels of the class ever built. The designs of these were at once put in hand, and tenders invited for their construction. Of those submitted, that of the Naval Construction and Armaments Company, Barrow-in-Furness, for the Powerful, was accepted; the building of the sister-ship being entrusted to Messrs. J. and G. Thomson, of Clyde Bank, Glasgow. As the Powerful is now undergoing her machinery trials, and in all probability will be the first of the two completed, a description of her, with that of her propelling machinery, equipment, &c., may be given here. It will equally apply to both vessels.

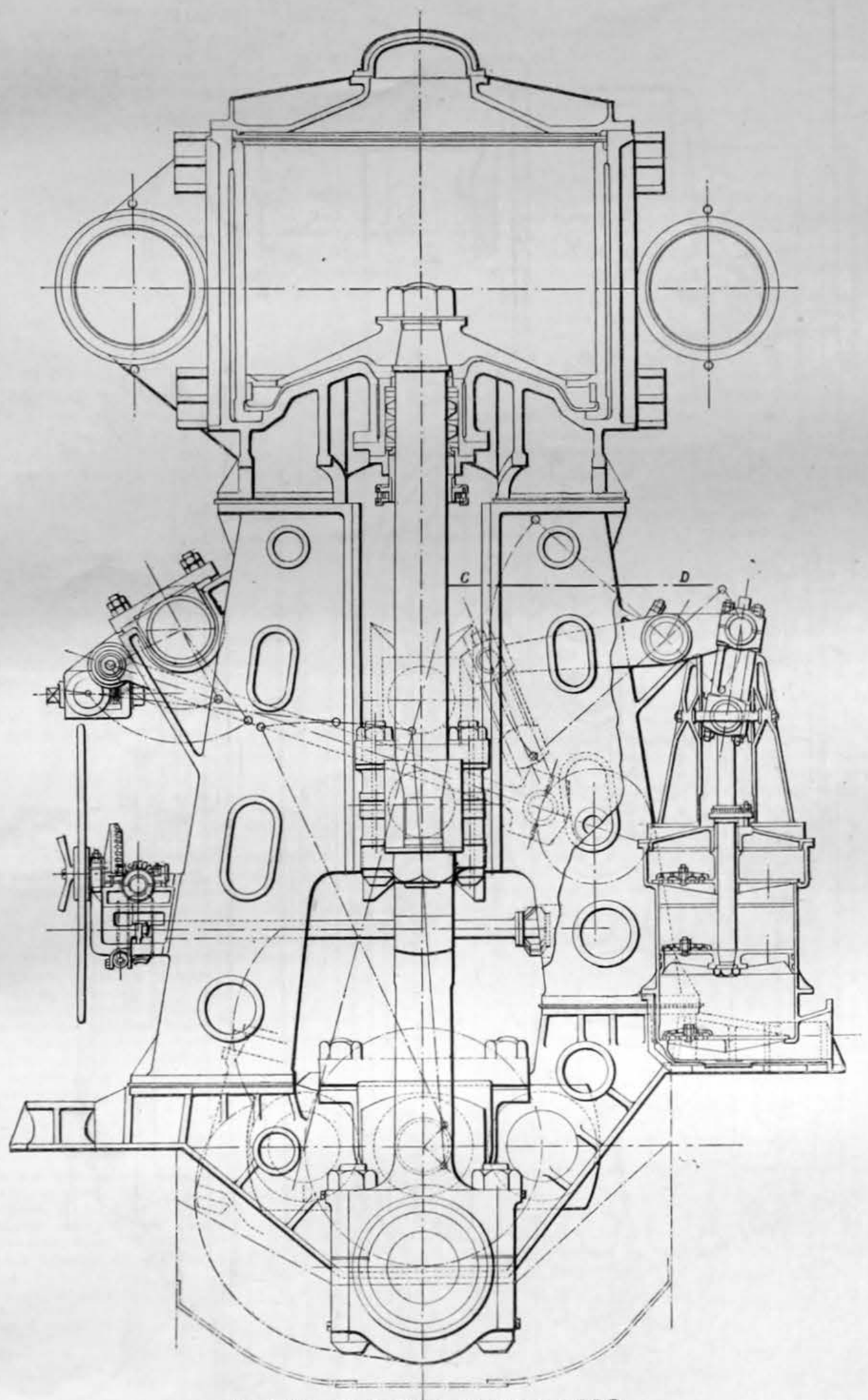
As some departure has been made in her construction from that of previous vessels of the same class, she practically becomes a new type of cruiser, in that all side protection is dispensed with, and in its place is substituted an armoured deck, which offers powerful resistance to the penetration of projectiles; the resisting power of the usually-fitted belt being added to the normal strength of the deck.

The Powerful, whose construction was commenced early in 1894, is of the following principal dimensions:—Length between perpendiculars, 500ft.; over all, 538ft. She has a beam of 71ft., and at her load draught of 27ft. she displaced about 14,250 tons. She is composed entirely of steel, with the exception of her stem, stern, and rudder frames, which are of phosphor bronze, these latter being heavy castings, totalling some 50 tons in weight.

In the hull proper, great pains have been taken by a skilful disposition of the material to obtain extreme lightness, combined with great strength and rigidity. The vessel has six decks, viz., platform, orlop, protective, main, and upper and boat decks. The protective or armoured deck runs the whole length of the ship, and is of great strength, being 4in. at its thickest part, tapering to 3in. at the ends, and is made of three thicknesses of steel plate. This deck dips at the ship's sides 7ft. below the load water-line, and rises 3ft. 6in. above it on the middle line, thus giving 10ft. 6in. of camber, and enabling the tops of the engine cylinders to come under it without resorting to armoured engine hatch coamings, as in some late cruisers. By adopting this design of protective deck a good depth and breadth of coal armour is provided on both sides of the ship. The vessel has no external keel, and is structurally built on the bracketed system. Being intended to keep the sea, the hull is sheathed with teak and coppered. Heavy bilge keels, 224ft. long, are fitted on each side, and are metal sheathed. The rudder, which is on the balanced principle, is some 15 tons in weight and of large area.

The ship internally is divided into compartments by numerous transverse water-tight bulkheads; 240ft. of the middle length of the vessel is occupied by the machinery space, which is divided up into ten compartments, two of which are devoted to the propelling engines, and the remainder to the boilers; a longitudinal middle line bulkhead running through the whole of this length.

Between the armoured protective deck and the one above it—the main deck—the whole of the 240ft. of length is divided up by numerous water-tight bulkheads into coal bunkers, which, when filled, form a coal protection for the whole of the machinery space, the horizontal thickness of coal being between 9ft. and 10ft. As we intend in subsequent issues to give further constructive details of the vessel, and of her propelling and auxiliary machinery, we shall now briefly describe the main engines, and also note the kind of boilers with which the vessel is fitted, and which we illustrate in detail on page 338.



Port Engine Section through AABB.
Looking Aft.

TRANSVERSE SECTIONAL ELEVATION OF THE ENGINES OF H.M.S. POWERFUL

The propelling machinery of the ship consists of two independent sets of inverted four-cylinder triple-expansion engines, driving four cranks, designed to develope about 25,000-indicated horse-power when running at about 110 revolutions per minute, with 210 lb. steam pressure at the engines. The sequence of the cylinders is, one high-pressure, one intermediate pressure, and two low-pressure, as shown in our engraving. Each engine has two air pumps, one worked off the high-pressure cylinder crosshead and the others from the forward low-pressure crosshead, and a separate main condenser.

The boilers supplying the engines with steam, which are 48in. in number, are of the Belleville water-tube type, and are located in eight separate water-tight compartments or boiler rooms, which are all forward of the engines.

We give on page 338 views of two of these boilers, but as we intend in a subsequent issue to describe their constructive details, and fully report the results obtained with them when under trial, we defer further reference to them at present. We may, however, here state that their working pressure is 260 lb. per square inch, reduced at the high-pressure cylinder to 210 lb. The total fire-grate area is 2200 square feet, and the total heating surface 67,800 square feet.

H.M.S. Cruiser Powerful is at present undergoing an exhaustive series of trials in the English Channel. The bad weather last week occasioned a postponement of the thirty hours' run at 5000 indicated horse-power, the ship having to return to Spithead on Friday night after eight hours' running, owing to the gale then blowing. She did not again get under weigh till the following Monday morning, the 28th ult., a fresh thirty hours' run being started at about 9.45 a.m. The after sixteen boilers only were used. The following averages were obtained. Steam in boilers, 225 lb.

	Starboard.	Port.
Vacuum	26·8	27
Revolutions per minute	67·4	67·0
Mean pressures—		
High-pressure	35·6	37·6
Intermediate cylinder	11·05	11·85
First low-pressure cylinder	5·6	6·04
Second low-pressure cylinder	5·6	5·32
Indicated horse-power—		
High-pressure cylinder	927	972
Intermediate cylinder	694	742
First low-pressure cylinder	417	446
Second low-pressure cylinder	417	398
Total indicated horse-power	2455	2553
Collective indicated horse-power		5008

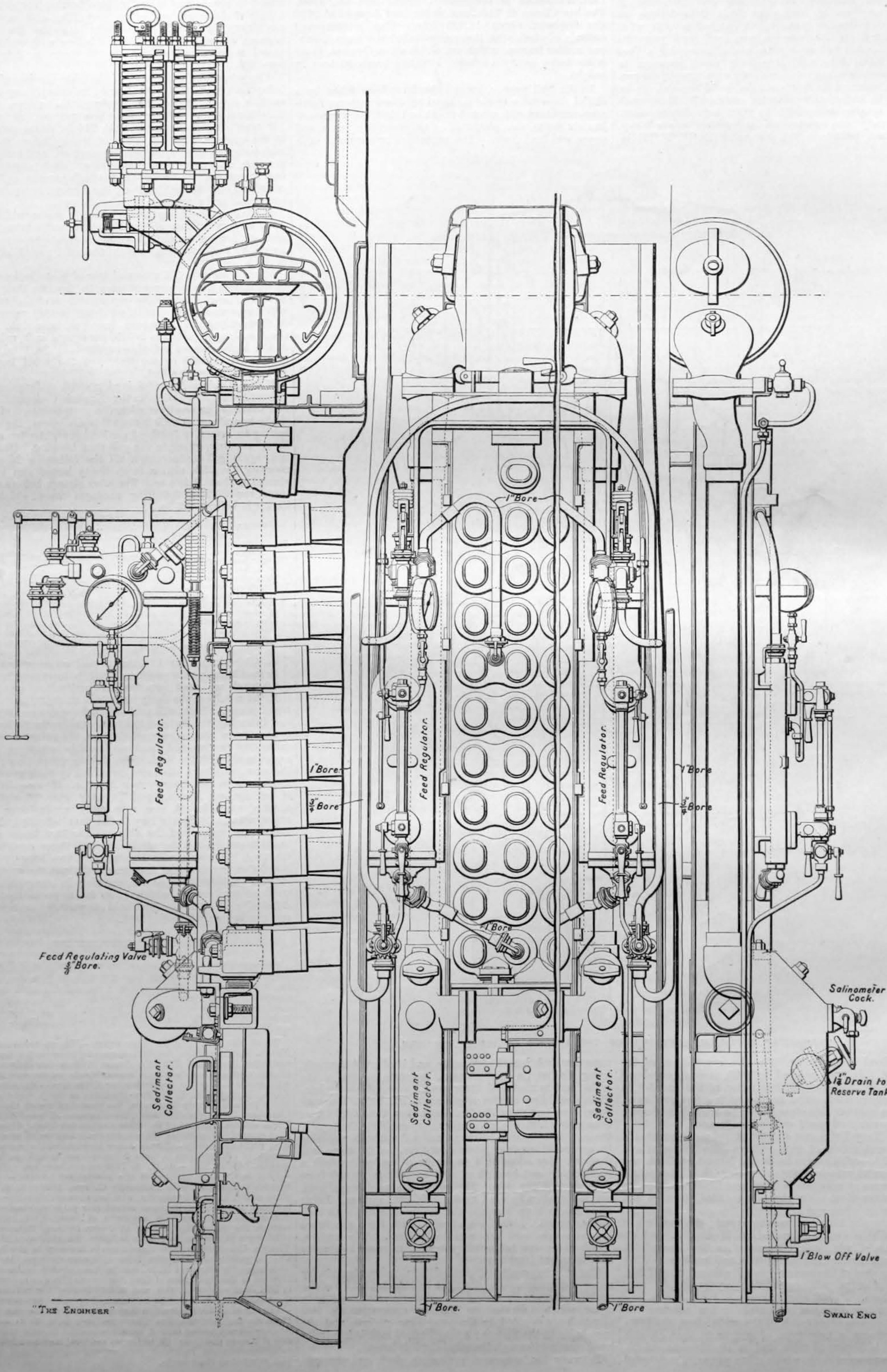
Speed, 14·0 knots for 27 hours; coal consumption per indicated horse-power per hour, 2·07 lb. for thirty hours. Next week we shall give further particulars, together with the results of the thirty hours' run at 18,000 indicated horse-power, which will probably take place on Friday and Saturday, the 2nd and 3rd inst. So far the Belleville boilers have given every satisfaction, the pressure being uniformly maintained, and no trouble whatever was experienced with the feed. The stoking seemed easy for the men, who have, of course, benefited by their previous experience in the sister cruiser Terrible. The conditions of weather on Monday and Tuesday were throughout most favourable. A few runs were made over the measured mile in Stokes Bay, the engines indicating about 5200-horse power and the ship making 15·3 knots with the tide and against the wind, and with these conditions reversed the speed was lessened by two knots. The Naval Construction and Armaments Co. and the engineer officers on board can, so far, certainly be congratulated on these good results, which go so far to prove that the Admiralty in taking this bold departure in marine engineering were fully justified.

Munsted's Margarine Factory.—In the article on these works in our impression of the 18th inst, page 292, the word *the* in line ten of the first column should have been *steam*, and the word engine should have been *engines*. Mr. Schon writes to point out that the condensers referred to save from 85 per cent. to 90 per cent. of the water used by the old form of submerged condensers, not that they use 85 per cent. to 90 per cent.

Trade and Business Announcements.—We are informed by Messrs. Woods and Co., Suffolk Irownworks, Stowmarket, that on and after September 28th Mr. Ernest William Gouldstone will become manager, and that Mr. Clement Woods, on the same date, will cease to act as the representative of the firm.—Mr. John T. Eayrs, M. Inst. C.E., F.S.I., Past-President of the Association of Municipal and County Engineers, has opened offices at Clarence Chambers, 39, Corporation-street, Birmingham.—Messrs. Richard Nevill and Co., Limited, of the Wern Engineering Works, Llanelly, have secured the order for the reversing mill engines for the new steel works at Llanelly.—Messrs. James Menzies and Co., announce change of address from 6, Lime Street-square, to 4, Fenchurch-avenue, London, E.C.—Mr. T. E. Stanton has been appointed—subject to the confirmation of the senate and council—senior lecturer in Engineering in University College, Liverpool, in the place of Mr. Stanley Dunkerley, who has gone to Cambridge. It is stated that the new lecturer served four years' apprenticeship with Messrs. Gimson and Co., engineers, of Leicester. In 1888 he entered the engineering courses at Owens College, Manchester, obtaining a Whitworth Exhibition in 1890. He graduated at the Victoria University with a First Class in Honours in the B. Sc. Degree, gaining the Fairbairn Prize at Owens College. He has since taken his Degree of M.Sc., and has been elected an Associate Member of the Institution of Civil Engineers. He was appointed in 1891 Junior Demonstrator, and in 1893 Senior Demonstrator at Owens College, which post he has retained up to the present time. —The offices of La Locomotion Automobile have been moved to Place de la Madeleine, Rue Chauveau-Lagarde, 4, Paris. —Mr. Andrew Kesson having retired, we are requested to state that the firm of Keeson and Campbell, engineers and ironfounders, of Greenfield, Hamilton and Parkhead, Glasgow, will continue their business as usual at these works.

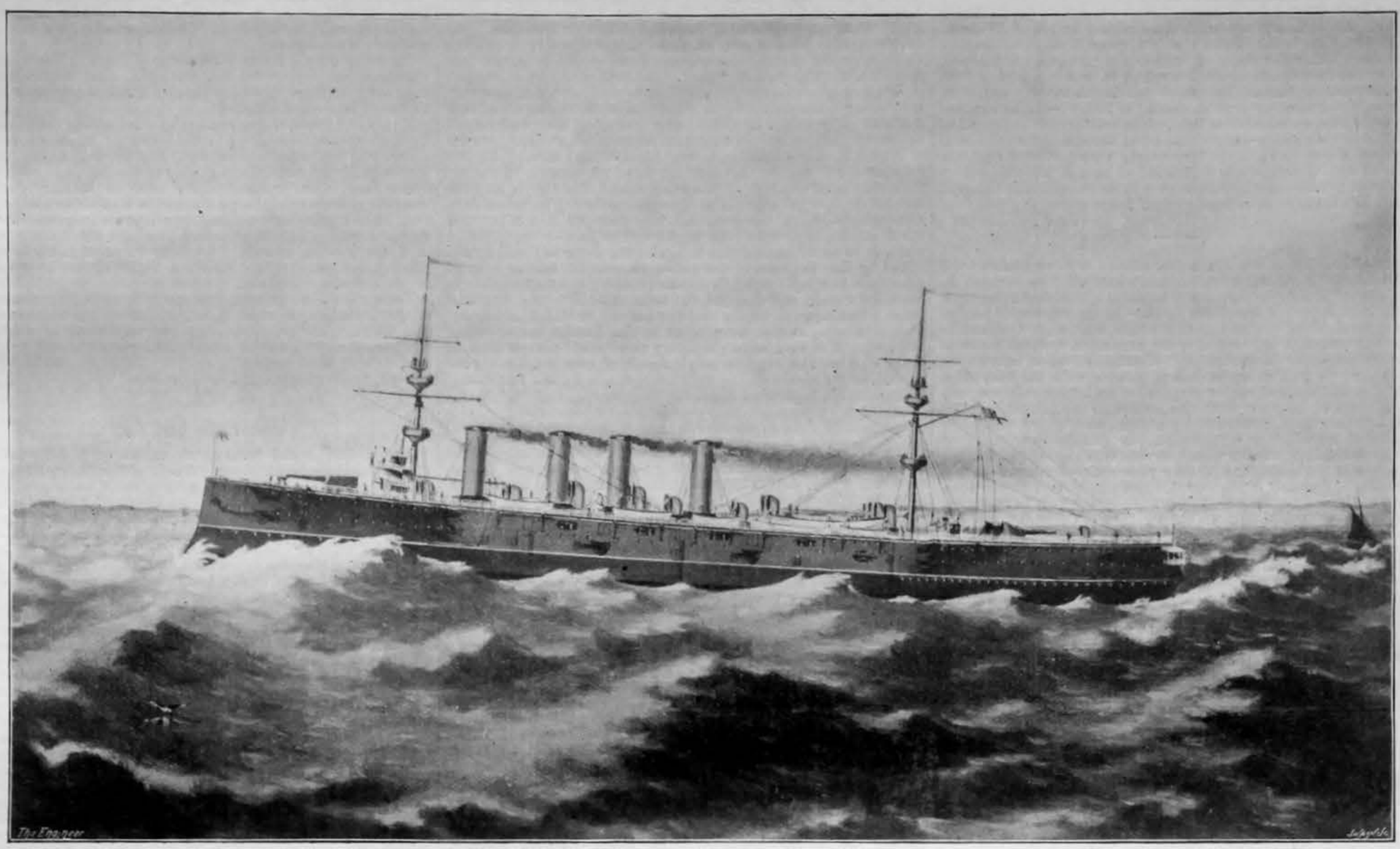
BELLEVILLE BOILER AND FITTINGS—H.M.S. POWERFUL

(*For description see page 337*)



H.M.S. POWERFUL AT SEA

(*For description see page* 337)



LETTERS TO THE EDITOR.

(*We do not hold ourselves responsible for the opinions of our correspondents.*)

A LINK IN LOCOMOTIVE HISTORY.

Sir,—I enclose you views of an old-world locomotive whose career has just ended, thinking you may consider it worth a passing notice.

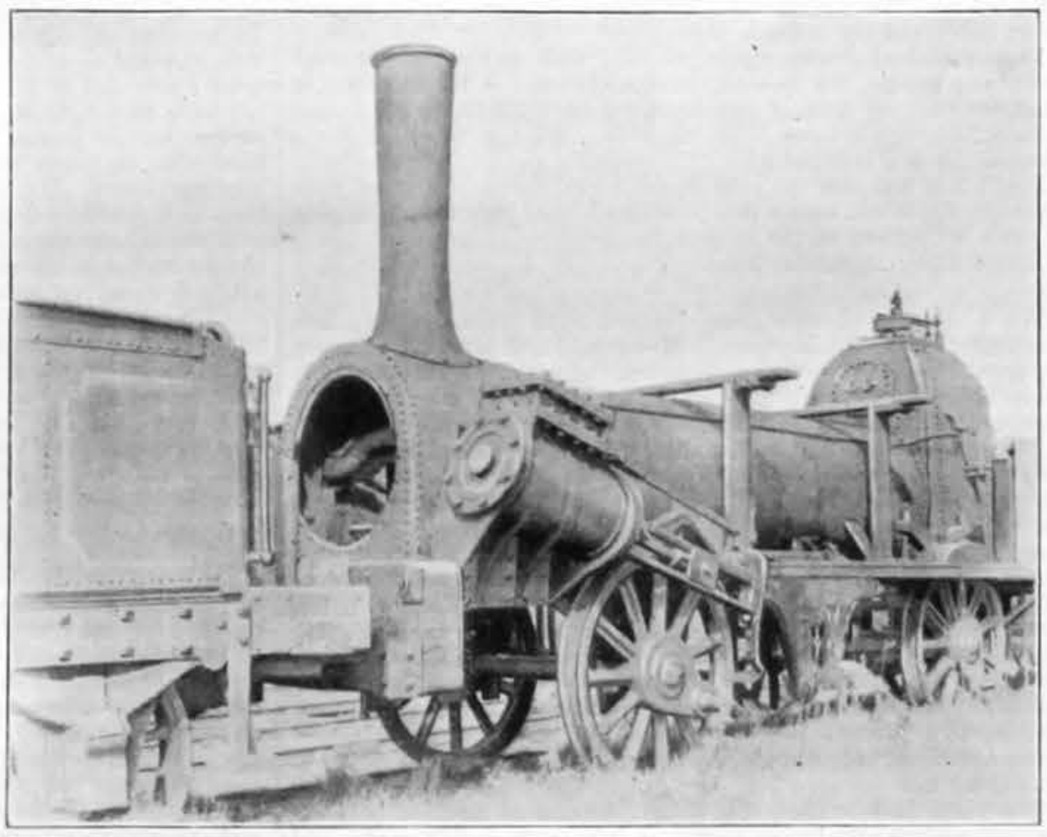
Built in the forties under the late Mr. James Thompson at Kirkhouse, in Cumberland, her life was spent in the useful but unexciting occupation of drawing coal trains along the Midgeholme Colliery line, the same, by the way, over which tradition declares that the Rocket once ran four miles in four and a-half minutes. (As to this latter performance I admit to feeling somewhat sceptical, but if it really was accomplished it deserves to rank amongst the most remarkably things in railway history.)

After running for nearly forty years her work as a locomotive came to an end in the winter of 1885-6, when the stationary engine plant at a pit being in urgent need of assistance, she was jacked up and uncoupled, grooves were cut in the driving wheel tires and wire ropes passed round them, and she then worked as a stationary engine until the closing of the pit a few months ago.

She has now been broken up. The boiler is to be preserved, and will probably serve a useful purpose for many years to come; the remainder goes to the scrap heap. The following were her principal dimensions:—

Cylinders	13in. by 22in.
Boiler—length of barrel	11ft. 10in.
Diameter of barrel ..	3ft.
Thickness of plates ..	$\frac{3}{8}$in.
Tubes	78
Diameter of tubes ..	$1\frac{3}{4}$in.
Diameter of blast pipe	$3\frac{1}{4}$in.
Total wheel base ..	10ft.

The driving wheels had no flanges. The working pressure was, I believe, originally 100 lb., but did not exceed 80 lb. at any time to which my own memory extends. The boiler was made of five plates, each extending its whole length, and lap-jointed longitudinally. No provision was made for expansive working, there being only two positions in which the reversing lever could be fixed, one for forward and one for backward gear. Unfortunately the driving wheels and smoke-box door had been removed before the photographs were taken.



OLD LOCOMOTIVE, MIDGEHOLME COLLIERY

At ten or fifteen miles an hour this grotesque old engine was capable of taking loads which I daresay would have surprised many people accustomed to modern practice.

September 29th. W. B. Thompson.

GAS *v.* ELECTRIC TRACTION FOR SHEFFIELD.

Sir,—As The Engineer—current issue—apparently favours a suggestion by Sir F. Mappin to employ gas for tramway traction in Sheffield, permit a brief statement of facts in favour of the rival methods electricity and cable, and to suggest that whilst gas, on the score of cost, "may be" admissible in the ozone-laden atmosphere of Blackpool, the case is different in Sheffield. A view tersely put by "Arcturus" in the *Sheffield Telegraph* deals with Sir F. Mappin's proposal as follows:—"Each explosion would vitiate so much air, and this vitiated air has to be discharged in the street, and the quantity of exhausted or vitiated air from which our atmosphere now suffers is a serious drawback to existence in Sheffield. Electricity has this virtue, it is faultlessly clean."

Sir, it is obvious the sole advantage which even the cheap gas supply of Sheffield offers for traction is a problematical difference in mileage cost compared with electricity produced under ordinary conditions, and I hope to show clearly this advantage, whatever it may be, would disappear; and that electric traction offers the city an opportunity to largely improve the existing sanitary conditions by a simple combination of process and reduction of cost at present incurred for municipal work, basing the proposition on the valuable facts regarding refuse disposal determined at Leeds by Dr. Spottiswood Cameron, the Medical Officer of Health, briefly as follows:—(1) All forms of nuisances cease with destruction carried on at a heat at or above 1500 deg. (2) Double the weight of refuse is reduced at 2000 deg. compared with 1500 deg. (3) The maximum heat available with steam jets or forced draught with cold air is 1500 deg. (4) The weight of clinker or residue at 1500 deg. ranges from 35 per cent. to 40 per cent. (5) The cost of destruction at 1500 deg. is for wages 19·52, or, including capital charge at 4 per cent., 24·64 pence per ton of refuse, or about the average cost of tip disposal. From the above facts resulting from burning upwards of 180,000 tons of refuse, it is clear the question of nuisance, cost of collection, cost and quantity of disposal, and weight of clinker, are one and all dependent on the degree of heat employed.

Sheffield is erecting a destructor plant at a cost of £16,000 inclusive, which will not reduce present cost any way, and in view of further outlay in this direction soon, my proposition takes the form of mechanically operated cells, worked by a special form of regenerator plant to utilise the waste gases from the boiler plant producing power for electric or cable traction; the steam plant at all times having an independent flue to the chimney. The gases alone would supply the cell atmosphere at a heat ranging from 1200 deg. to 1500 deg.; the regenerator supplying hot blast to work the cells. Consequently it would be much simpler and easier to work the cells at 2000 deg. to 2500 deg., than it is to work the ordinary cell at 1500 deg. with steam jets, or forced draught with cold air in the usual way. The labour would be reduced 50 per cent. to 75 per cent., whilst owing to the simpler form of plant and its cost, and area required, destruction relieves electricity of the cost of chimney, and flue, and boiler plant as well, compared with either tip or destructor disposal in the usual way.

The general financial aspect of the mileage cost of either electric or cable traction produced under the condition named compared with gas for Sheffield is seen from the following illustration drawn from the city accounts for 1895, viz., the present cost for refuse disposal by the tips on the city outskirts added to sludge disposal cost is roughly £27,000 per annum, which is diverted to the combination proposed, carried out at E. W. and W. Central Station, would, after providing £10,000 for collecting refuse, pay 4 per cent. interest, and 5 per cent. depreciation on a capital outlay of £100,000 for electrical traction, and 5 per cent. interest on destructor outlay of £25,000 to abolish the tips, and still leave a sum of £5500 towards the joint working expense.

By transposing Sir F. Mappin's proposal—*re* gas motors—into electric street light in substitution for gas, we get a splendid "load factor" in combined traction, light, power, and refuse, with the following results:—Last year the cost of gas and wages for street light in Sheffield was roughly £19,000, a sum sufficient to provide 4 per cent. interest, and 5 per cent. depreciation on electric outlay of £100,000, and leave £10,000 per annum towards the joint working expenses for traction, light, and refuse, on terms whereby the city in twenty-five years would own its own traction, street lighting, and refuse disposal works, without increasing the present actual cost of street light and refuse alone, whilst in the interval it would possess a source of increasing revenue in traction, light, and power; whereas by adopting Sir F. Mappin's proposal to employ gas traction, the city at the end of twenty-five years would have nothing beyond the problematical difference between the mileage cost of gas and electric traction produced under ordinary conditions.

827, Grimesthorpe-road, Hill-Hartland.
Sheffield, September 28th.

PERMANENT WAY.

Sir,—On the occasion of an accident in Scotland, arising from the expansion of railway metals, a few months ago, I wrote you a letter, treating upon the subject of expansion generally, a matter that had occupied no little of my attention in byegone years; and I mentioned that a "range of 160 deg. Fah. was very possible, if not even probable, to occur in England any year;" and I made out that, under these circumstances, the difference in the length of a 30ft. rail would be as near as possible $\frac{3}{8}$in.

I am induced to refer to this subject again, in consequence of your printing a letter in last week's issue from a "P.W. Inspector" in India, only referring to it, as I take it, to be an illustration of what I meant to convey in my first letter to you on this subject, by the "navvy" or "rule-of-thumb" element displayed even at this day, at least in the matter of expansion.

Mr. Derry says that he has on two occasions tested the expansion of four rails of 30ft. each, fished together as one rod; and in one case, on their being subject to a range of 50 deg. of temperature, he obtained $\frac{5}{8}$in., and in another case, with a range of 75 deg., he obtained $\frac{7}{8}$in. expansion for each rail. I do not see, however, any connection between these results and his remark that "in neither case did the expansion touch $\frac{3}{8}$in." How he could think that this amount was possible with a range of only 75 deg., while he must have gathered, from what I said, that a range of 160 deg. was necessary, I don't know.

Mr. Derry seems to have understood me to say that 80 deg. would be "the mean temperature of England," when I only took 80 deg. as the mean of the extreme possible range in England—a very different thing; but this has given him the opportunity of saying that, considering the mean temperature of India to be "no more than 80 deg., and the mean temperature of England to be 60 deg., therefore the expansion in this country—India—should be more than that given in England." May I tell Mr. Derry that mean temperature in this case means nothing, but that extremes of temperature, which might possibly have but very small result on the mean temperature, means everything in the case we are illustrating, and, therefore, upsets his idea that less expansion is required in England than in India.

I have to thank Mr. Derry for his practical corroboration of my

views of the consequences attendant on the "grip of an unyielding fish-plate," and how they get over that matter in India. It is a little singular that this should be recognised in a country where the range of temperature cannot be so much by some 50 deg. as it is in England, and means are taken there that are not taken here to avoid the evil consequences of it.

May I ask the opinion of some of your readers on the following matter. An ordinary mercurial thermometer stands at 35 Cent., or 111 deg. Fah. in the shade, and in the sun it reads 156 deg. I have also a 28ft. rail equally exposed to the sun, and which I find, even by the inadequate means I employ, to be 8 deg. higher than my thermometer reads. This same rail in winter, exposed some days to a temperature termed "cold" of 26 deg.—which happens also to be 26 deg. below zero Fah., gives a difference in length of 3·64 eighths of an inch—an amount equal to requiring a calculated range of 210 deg. Fah., or very nearly that. Where does the extra 30 deg. of temperature come in? I have a decided opinion about this; but before I occupy your time with it, Mr. Editor, I should like to see some of your readers' remarks on it.

J. W. Wilkins.

Sir,—Referring to Mr. Watkins' remarks in your issue of the 18th inst., if I have misquoted or misunderstood him I regret it. His letter of 31st August is not now before me, but I understood him to say that makers of fish-plates do not—in them—provide for the safe expansion and contraction of the rails, and what I wished to point out was, that any provision for expansion must be made in the rail, not in the fish-plate. Mr. Watkins, however, informs the world through your columns that it consists with his knowledge that I would allow $\frac{1}{8}$in. for expansion in laying rails on any and all days of the year, from the coldest to the hottest. This is a rather hazardous statement by a man who knows absolutely nothing of my mind or my practice. In specifically referring to temperature, I supposed it would be seen that the subject was not forgotten or neglected, and to save your space I did not pursue it further. The fact is that on this line attention is at all times given to the temperature of the day. In laying rails in the open, the $\frac{1}{8}$in. gauge is used at mean temperatures. On sunny summer days, when the rails are often hot to the touch, they are laid with their ends butting close on each other: and in times of frost care is taken to allow something more than $\frac{1}{8}$in., sometimes nearly $\frac{1}{16}$in. In a tunnel about $1\frac{1}{4}$ mile long, wherein there is no great variation of temperature, the expansion pieces used at ordinary temperatures do not exceed $\frac{1}{32}$in. Under the arrangements above described, my experience warrants me in saying that in this climate the way is quite safe from buckling.

From my having said that the fish-bolts are made to fit easily in the plates, Mr. Watkins seems to think that by this means provision to some extent is intended to be made for expansion. My remark was really made to show that, although no play is intended to be given in the fish-plate, the bolts are made to go easily into place so as to avoid interruption in laying the way.

As to the rail, the difference in diameter between the bolt and the hole, viz., $\frac{1}{8}$in., is by no means accidental, as Mr. Watkins thinks, but is a dimension arrived at after careful experiment; and I can only repeat that it is the play thus given to the rail that provides for expansion, and not anything in the make of the fish-plate.

Cor. Lundie, Engineer.

Rhymney Railway. Cardiff, September 30th.

LOCOMOTIVE PERFORMANCES ON THE CALEDONIAN RAILWAY.

Sir,—I have carefully read the letters of Mr. Rous-Marten appearing in your numbers for August 21st and September 11th, giving particulars of runs made by him recently in certain of the fast trains over the Caledonian line, and with reference to which he accords what I venture to think is a superfluous share of praise to the new Dunalastair class of coupled bogie locomotives running on the Caledonian. Allowing that each of the runs quoted is an excellent example of locomotive work performed over a heavy piece of road, they are in no wise superior to the performances of Mr. Drummond's original express engines for the past ten years; and even at the risk of being thought very stupid by your correspondent, I quite fail to see the extraordinary merits of these new engines. To most people the performances of the Dunalastair engines have been distinctly disappointing thus far after all that was heard of them when they were newly built. From careful observation and inquiries made upon the subject, I have yet to learn that they can take the least heavier load or run one bit faster than any of their predecessors. One thing is certain—that they will need to prove extraordinarily good engines if they are going to excel the performances of the old bogies, of which I can refer Mr. Rous-Marten to several fully as good, and, indeed, some better than those mentioned in his recent communications to The Engineer.

Mr. Rous-Marten quotes as one of the "extraordinary" performances of the Dunalastair class a run from Perth to Forfar, 32½ miles in 32 min. That the work is excellent I am not going to deny, but the only extraordinary part of it, so far as I can see, is that it is the fastest timing of any train ever given in Bradshaw. It will be noted that in this case the total train load only amounted to 101 tons, or about 20 tons more than the light racing special to Edinburgh in 1888; and if a 46-ton locomotive, with 18½in. cylinders and more than 1400ft. of heating surface, could not accomplish a mile a minute with such a light train, it would indeed be extraordinary. Apropos of this run, the Perth express due into Carlisle at 12.30 p.m. was timed last summer to run the 14 miles start to stop between Beattock and Lockerbie, in the even quarter of an hour. The train was regularly worked by the old bogie, with loads up to sixteen vehicles, and rarely failed to accomplish the task set within time. I leave it to your readers to judge as to which of the two performances is the most meritorious.

Another "superb" run by one of the 721 class, Mr. Rous-Marten tells us, was that from Carlisle to the Summit in 63 min. I have before me the record of a really superb run over the same ground a good many years ago, and long before the Dunalastair was thought of, where one of the 6ft. 3in. rebuilt goods engines, now thirty years old, hauled a train of seventeen coaches—two more than the Dunalastair had on—in 64 min., steadily maintaining a mile a minute the whole way from Carlisle to the foot of the bank. This for an engine of the class was really superb, and shows that the Dunalastairs are not so very far ahead of the times as we are expected to implicitly believe.

I have only one other instance to quote, namely, anent the running between Forfar and Perth, which Mr. Rous-Marten tells us was accomplished once by one of the 721 class in 32 min. Three summers ago I covered the distance myself with 123 in half an hour; and the officials running the 5.40 express from Aberdeen told me recently that with this engine it was never run in anything over that time, and was frequently covered in 29 min., and even 28 min., so that there can be nothing whatever new or wonderful in one of the Dunalastairs doing it in 32 min., the whole distance being practically a falling gradient. The marvellous performances of this well-known locomotive are too well known to need comment; and if any of the 721 class could run day after day as she did from Carlisle to Edinburgh in 107 min. during the greater part of a month, I should be ready to believe they were as good. I could quote plenty more performances of the Caledonian engines, both new and old, fully up to anything that the Dunalastair has done or is ever likely to do, but I have given sufficient already I think.

Edinburgh, September 23rd. J. G. W. Butler.

LEADING BOGIES.

Sir,—Under the above heading I notice in The Engineer of the 18th inst. a letter from Mr. W. B. Thompson, in which he remarks that the Gladstone and 230 classes on the Brighton and Great Northern Railways respectively have been reserved by the advocates of bogies for their choicest invectives. Now, as I have myself mentioned these engines in connection with the same subject, it is only right to say that, so far as I am concerned, this statement of Mr. Thompson's is wholly misapplied. Reference was made to the engines strictly in a comparative sense, and only on the assumption that if bogies were necessary for such short locomotives as the North-Western "Precedents," there were "other engines which might much more reasonably have the flexible wheel-base." As I have already pointed out, all three classes have been running with success for years. No one wishes to overlook the fact, or that there are many other "fine" rigid and radial axled engines to be taken into consideration. That is not the point, however. It is surely better to err on the right side of the matter and choose the least of two evils by still further reducing the possibility of accidents. It is not often we get an impartial view of the question of bogies *v.* single-leading axles. Lieut.-Col. Yorke, R.E., has expressed an opinion, which is, therefore, worth repeating. Referring to an accident on the West Island Railway on May 6th last, he says:—"The fact that the engine did not leave the rails, although the rest of the train did, may probably be attributed to the flexibility imparted to the engine by the leading bogie, which was able to adjust itself to the irregular curvature of the line, produced by the expansion of the rails; whereas the tender, with its six-wheels and rigid-wheel base, was probably the first vehicle to leave the metals, and dragged the train after it." The common-sense advantages of bogies as here defined cannot be easily explained away. Bogies have other duties besides mere weight carrying. If it were not so, ordinary axles would answer quite as well, whether the engines weigh under or over the limit your correspondent speaks of.

F. W. Brewer.

London, N., September 22nd.

LOCOMOTIVE BOILERS.

Sir,—It is beyond question that the boiler of a locomotive ought to be able to supply all the steam that the engines can use. I have read with a good deal of interest and some amusement all that has recently appeared on this subject in your correspondence columns. It is clear that these letters are not written by railway men. They are obviously penned by men whose knowledge of the practical working of locomotives is limited to what can be learned by the ordinary railway traveller who keeps his eyes open. The letters are, in a sense, none the worse for that, because the intelligent traveller can learn a good deal without standing on a footplate. All the same, it is time, I think, to direct the attention of these gentlemen to something which they have quite overlooked. They one and all coolly assume that the average English locomotive cannot when running maintain its pressure within a few pounds of the safety valve load. I have no hesitation in saying this is not true. The arguments held in favour of bigger boilers are based from first to last on a fallacy. They imply that while the engines are all that can be desired, the boilers are too small to supply the proper quantity of steam to the engines. I venture to challenge any one of the half-dozen gentlemen who have been writing in favour of big boilers to prove this. I want them to name the class of engine on any line which will not make steam enough to maintain the full boiler pressure. If they can do this then we shall know where we are.

My experience has been gathered on the footplates of engines on the London and North-Western, North-Eastern, Midland, Great Western, the Brighton line, and the Great Eastern and the Great Southern and Western of Ireland. It extends over more than thirty years, and I can safely say that in all that time I have never known an engine run short of steam, unless the fireman was incompetent, and the coal exceptionally bad.

Mind, I do not say that locomotives are always powerful enough for their work. The direct proof that they are not is shown by the increase in the size of engines daily in progress. But this has nothing to do with the matter in hand, which is the argument that English engines are badly proportioned.

There is another point which your correspondents quite overlook. Is it true that the big boilers used in France, America, or Belgium, make more steam than English boilers? I never was in America, so have no practical experience of locomotives there; but I know Belgian engines well, and I am sure that they do not make as much steam per hour as an English engine of much smaller size. They have enormous grates, on which they burn a poor, dead slack. The shovel is never out of the fireman's hand. If the coal evaporates 5 lb. of water per pound of coal it is the maximum, and that result is only got by using tubes 14ft. or 15ft. long; the coal poor, as it is expensive. An English engine has tubes 10ft. 6in. or 11ft. long. You, Sir, have very properly pointed out not long since that the extra tube length adds but a small fraction to the steaming power of the boiler. But foreign locomotive superintendents are always straining after what is really only a theoretical gain; hence the big boilers.

In the United States, again, we find that, in spite of the great size of the boilers, the quantity of coal burned is far in excess of what we use per foot of grate. They burn 100 lb. to 150 lb. per square foot, against our 60 lb. or 80 lb. Why is this? Is it not because the coal is inferior?

I will not trespass on your space further, but if any of your correspondents will tackle the questions I have put, I shall be glad to say a little more on the subject.

Manchester, September 22nd. Gorton.

Sir,—I have read with great interest your article on page 266, also the letters of Mr. Norman D. Macdonald and Mr. F. W. Brewer—pages 211 and 263—on the subject of "Locomotive Boilers." It seems to me we all mean the same thing, though we may express it in various ways and look at the case from different view-points.

Assuredly we all concur in holding that engines must have ample boiler power for the duty required of them, with some margin for emergencies. Mr. Macdonald urges that they must have large heating surface. I agree with him. You say that heating surface is only one of several factors that make for power. I agree with you. Also, conditions must be taken into account. No one would advocate putting a Dunalastair boiler on a Brighton Terrier, or *vice versâ*. But it is noteworthy that the Brighton express engines—Gladstone class—have even larger heating surface than the Dunalastairs—viz., 1492 square feet as against 1403 square feet—but the South-Eastern 7ft. coupled engines, with virtually identical duty and tractive force—111 lb. per pound of effective steam pressure—have, I believe, only about 1020 square feet, yet seem to perform equally well.

The plain fact is that the whole question of relation between heating surface and boiler power, and between boiler power and cylinder dimension, is still entirely in the experimental stage. It is no imputation on the competence of our locomotive engineers to say this; indeed, they display the truest capacity and soundest sense in pursuing these important and valuable experiments, of which some have proved successful and others the reverse.

But adequate boiler power is the paramount need, whether it be gained by large heating surface, as in the case of the Great Western 7ft. 8in. singles, the Caledonian Dunalastairs, the Brighton Gladstones, and the North-Western Teutonics, or as it was so remarkably in the case of the old broad-gauge singles, with their 1952 square feet of heating surface; or whether it be obtained by a combustion chamber, as in the London and North-Western Greater Britain class, or by the Belpaire fire-box, as in the new Manchester, Sheffield, and Lincolnshire engines, or by the Flamank double boiler, or by larger fire-boxes and fire-grates. All these different systems are still on their trial, and judgment must for the present be reserved.

September 12th. Charles RousM-arten.

NOTES ON WEIGHBRIDGES.

Sir,—We are glad to see by your "Notes on Weighbridges," in your issue of September 11th, that a more general and intelligent interest is being taken in the highly important principles guiding the proper construction and use of weighing apparatus, and consider that the ventilation of this important subject by means of well considered and practical articles in your influential paper is a step in the right direction.

Mr. Kirby's remarks respecting the disadvantages of relieving gear are well set forth, and from our experience as the largest makers of weighing apparatus in this country, we can heartily endorse his conclusions.

Relieving gear is of very questionable benefit, as unless such machines are under careful and periodical supervision, and frequently adjusted, a fresh balancing of the steelyard is rendered necessary after such relieving.

A point of greatest importance in constructing weighbridges—by some makers overlooked in these cutting times—is the provision of a liberal margin of strength beyond that merely necessary for weighing up to the full capacity of his machine. Where such liberal margin is provided, there need be no fear of accidents from the passage over the platform of a load above such capacity, even when a relieving machine happens to be in gear. To obtain proper durability, the centres and bearings which have to stand such heavy wear or impact must be made of suitable width or bearing surface, a matter so often neglected, to the great after expense of the unpractical purchaser.

Your notes also rightly call attention to an important matter of danger to health to which public attention has not before been directed, viz., the proper drainage and ventilation of weighbridge pits, which are often little better than cesspools, and only tolerated from habit or neglect.

W. and T. Avery.

Digbeth, Birmingham, September 24th.

HORSELESS CARRIAGES.

Sir,—I had hoped some more experienced individual than myself would have commented on your article of the 18th.

You speak of the difficulty of getting rid of waste products, and you picture Cheapside packed with heavy oil vehicles, and infer that the smell would be a great nuisance. If, however, these carriages were moved by steam and fired with coke, I think there would be little to choose between the smell of the oil and the sulphurous, suffocating fumes of the latter. You, however, suggest oil as fuel to generate steam, but the cost of burning oil under a boiler is far greater than burning it in the cylinder of an engine. An oil engine of 4 or 5-horse power will consume about seven-eighths of a pound of oil per brake horse-power hour. In the small engines of a motor carriage we can hardly expect such economy as in the larger engine, and 1 lb. of oil—taking the oil at 6d. per gallon—would produce 1 brake horse-power hour, costing three farthings. On the other hand, the oil-fired boiler will take at the lowest estimate with a good compound engine 2½ lb., costing 1⅞d. to obtain the same power. The oil-fired boiler will thus cost to work more than double the expense of the internal combustion engine. This is assuming that ordinary lamp oil is used; any of the cheaper oils, such as crude oil, may be dismissed, as they are practically unattainable in England.

A great advantage of oil fuel over coke is the ease of manipulating the fire on a long down grade, or in case of a sudden stoppage the oil is shut off and the boiler ceases to generate steam. If coke is used, as I believe it frequently must be, some self-feeding or some self-acting method of stoking will be wanted, either the Serpollet hopper or a revolving feeding scoop, as used in the Benier hot air engine.

You speak of the difficulty of starting with steam; there is no necessity for coupling the engine rigidly to the wheels; if engine is started first, and by a clutch the road wheels are brought into gear, there is less difficulty in starting than with a petroleum engine, or the engine might drive its gearing by the intervention of a spiral or twisted spring. For instance, the back-lash in the gear of a traction engine will enable the crank shaft to make perhaps one revolution before the road wheels are set in motion, and it will thus get away with a load that it could not move if the crank shaft were not free to start before the load.

Those who have ridden on both steam and petroleum carriages must have noticed how much more quickly the latter gets away than the former. A steam carriage starting reminds one of a goods train getting under weigh. If engine could only make half-a-dozen revolutions before the carriage moved, I believe it would obviate all difficulty in starting.

John Henry Knight.

Barfield, Farnham, September 29th.

Sir,—I have read the letter in yours of the 25th from Mr. Thomas Hill, and am very much surprised to find that he is not aware of the very important improvements that have been made in traction engine wheels. He refers to broad wheels with flat bars rivetted on at an angle to grip the road. Any practical man must know that in thousands of cases the flat cross bar wheel cannot have on a rigid Macadam or paved road one square inch of flat surface on the ground at once for adhesion. He says no improvement can be made towards contact with the road in the way of hauling power. Mr. T. Hill does not seem to be aware that we have in Lancashire traction engine wheels working for seven years past which have never less than 100 square inches of wood, end on of the grain, flat on the road constantly. He seems to be built up with a broad wheel for wear and tear. I have forty years ago and less run 100 miles a day on common roads with a steam carriage weighing over four tons and carrying nine passengers on three wheels, using only one wheel for driving, with a tire 3in. wide, wheel 5ft. diameter, engine, one cylinder, 4¼ diameter, 120 lb. steam, ascending gradients frequently 1 in 15. I quite agree with your correspondent that lots of people who take an interest in motor cars should make themselves acquainted with what has been done.

Ashton-under-lyne, September 26th. J. W. B.

Sir,—I think Mr. Hill mistakes what is the object of the motor car movement. We have quite enough—I think too many—traction engines now drawing heavy trains behind them which are quite unfit for country roads. Farmers cannot employ a great traction engine, but they could employ a farm wagon which had a steam or oil-driven motor below the wagon between the wheels, where there is plenty of room for it. Such a wagon would serve a farmer well for sending to his railway station to take farm produce there and bring back manure. For such work we want small engines. I think the Act allows too great a weight for the engine—three tons in one carriage and one ton for one carriage behind it "unladen." If the Act had been for one or two carriages, not having more than six wheels in all, and not to weigh more "when loaded" than five tons, it would have been much better. They would soon have displaced the heavy "trains" which now smash up the roads.

Penithon, Radnorshire. G. A. Haig.

ELECTRIC MOTOR CAR FOR THE QUEEN OF SPAIN.

Sir,—I do not wish to take any of the credit which is due to Messrs. Thrupp and Maberley for the excellent way in which the vehicle, *per se*, was designed and made, but at the same time it is only fair to state that the motor—Immisch type—together with the driving and controlling switch apparatus, was ordered from and supplied by me, and made under my designs and patents. The claims of the inventor of the primary battery for this carriage are, to say the least, remarkable, and certainly the space taken up by them is far less than any of the other electric carriages I have had to do with. It is to be hoped the Queen of Spain will duly appreciate the production of the English coachbuilder and engineer.

Newcastle-on-Tyne. Walter A. Clatworthy.

(*For continuation of Letters see page* 350.)

RAILWAY MATTERS.

Last Friday was the seventy-first anniversary of the opening of the Stockton and Darlington Railway.

The total length of Russian railways, exclusive of those of the Grand Duchy of Finland, on December 31st, 1895, was 21,961 English miles. Of these the Government lines extended over 13,602 miles, and those still belonging to private companies over 8359 miles.

The Liverpool, St. Helens, and South Lancashire Railway Company were on Saturday last fined £5 per day from May 31st this year to September 25th for not completing two railway bridges according to Act of Parliament. The total penalty up to Saturday was £1190. The proceedings were taken by the Golborne District Council.

Traffic on the Lancashire and Yorkshire Railway, near Rochdale, was delayed last week by a displacement of rails through the collision of a goods train from Normanton with a train of empty carriages that was being passed on to the main line at Wardleworth Junction. The Normanton engine struck the guard's van of the empty train, but the guard was in another vehicle, and no one was hurt. The engine was not damaged, but the van was knocked to pieces and some carriages were overturned.

No uniform system whereby, while a train is in motion, passengers may communicate with the guard and the driver has yet been adopted on the Indian railways. The Bombay, Baroda, and Central India Railway Company have, for some years, been using Winter's electrical system, and on the Great Indian Peninsula and the Madras railways different other devices have been tried. According to *Indian Engineering*, the Government of India are now moving in the matter with a view to see if some uniform system can be found suitable for adoption on all railways.

The horseless carriage movement is causing considerable interest in the Midlands. In the course of correspondence which has appeared in the Birmingham papers this week, it is stated that there is enough energy being put into the matter in Coventry alone to ensure a goodly supply, and that there are at least half-a-dozen men in Birmingham who intend to have their auto-cars in the streets next season; further, that it is probable that in a few weeks from now motor cycles will be offered in Coventry at from £60 to £70 each.

Major F. A. Marindin's report to the Board of Trade upon a slight collision which occurred at Waterloo Station on the London and South-Western Railway on the 29th August has come to hand. The collision was a very slight one, and was caused by a "light" engine, shunting out from the engine shed, colliding at a fouling point of the junction of this siding with a platform line, with the engine of a down passenger train which had just started from the main line platform. The engine of the passenger train was derailed, and the train, coming to a sudden stand, was run into from behind by a light engine, which had brought the empty train to the station, and was following it out in the usual manner. To prevent the recurrence of such accidents, Major Marindin recommends the company to put in a shunting neck, which would allow engines to be shunted up and down on these sidings without danger of fouling No. 3 line, protecting the cross-over road leading into the south station by means of safety switches on the engine shed sidings.

Some attention is being aroused by correspondence which has appeared in the Midland papers promoted by the Railway Nationalisation League, of 47, Queen Victoria-street, London, S.W., endeavouring to further the cause of the nationalisation of railways, and declaring the State railways ought to be the first plank in the legislation of next parliamentary elections. Mr. W. Wilson, dating from the offices of this body, writes, under date September 28th, declaring that fares and rates are kept high to pay for about 250 boards, staffs, departments, &c., when one central governing board would be more efficient. Two hundred and fifty million goods rates have been confusedly regulated by 977 Acts, while about 3000 more Acts deal incidentally. The Railway Commissioners by adopting general terms reduced 3000 items by 900, and further simplification is, he contends, quite possible. The Great Western Railway Company's share of the 250,000,000 rates is 25,000,000, requiring a large rate department and a library of 2000 large volumes; but the German rate-book for all their State railways is a pocket octavo of 76 pages.

A correspondent of the *Times* writes:—"A year before the passing of the Light Railways Bill in the English Parliament the Prussian Legislature had sanctioned a similar scheme for the development of minor railways in that kingdom. The operations have now been going on for about eighteen months, and the prospects are most promising. As in England, the chief object of these minor railways is to assist native agriculture in its present depressed condition. The first grant was made at the beginning of April, 1895, the sum of 5,000,000 marks being set aside for this purpose. On June 3rd of the current year—1896—the Prussian Parliament provided a further credit of 8,000,000 marks. From these two separate grants there have altogether been 712,000 marks allotted to different undertakings up to the present time, the money being advanced mostly in the form of loans at a low rate of interest and amortisable. Already the length of minor railways thus constructed is 143 kilometres. Demands for similar support have been received by the Prussian Government for upwards of 4,500,000 marks, which would bring the length of the line under the system up to 681 kilometres. Beyond this, however, there are six additional minor railways, which are soliciting loans from the Government representing a sum of close on 2,000,000 marks. Hence it would appear that the minor railway system in Prussia is being carried out with the greatest rapidity and success."

A largely attended meeting of representatives of Western Australian gold mining and other companies was held in London on Monday last, to protest against the proposal of the Western Australian Government to start the Menzies Railway from Southern Cross instead of from Coolgardie or Kalgoorlie. Mr. Allen H. P. Stoneham, who presided, pointed out that the matter they had met to discuss was one of vital interest, because while they, in London, had a very large stake in Coolgardie and Hannan's, they had very little interest in Southern Cross. For some time there had been a great deal of healthy rivalry between Coolgardie and Hannan's, each being desirous that the railway to Menzies should start from their particular town. This division of opinion, it seemed, had afforded a powerful clique an opportunity to push forward the claims of Southern Cross. From cablegrams he had received it appeared, however, that the people of Coolgardie and Hannan's had now joined forces against the common enemy. After observing that if the line were constructed from either Coolgardie or Kalgoorlie it would be shorter, and could be made in much less time than if it started from Southern Cross, he moved the following resolution:—"That this meeting of investors in land, mining, and finance companies carrying on business in Western Australia, having heard with surprise and concern that it is proposed to construct the Menzies Railway from Southern Cross direct, thereby delaying the opening of the rich gold-bearing districts between Coolgardie and Kalgoorlie, resolves (1) that the chairman of this meeting will be requested to communicate to the Government of Western Australia by cable and by letter to the effect that this assembly strongly protests against the construction of the railway from Southern Cross to the Menzies district, as it is opposed to the best interests of all investors in mining and other industries in the Colony; (2) that such a course would be mischievous in the extreme, and its adoption would be regarded as indicating an utter want of consideration on the part of the Government for the interests of those who have invested their capital in the colony."

NOTES AND MEMORANDA.

As illustrating the enormous stride which steel has made in steamship construction, the gross tonnage of vessels under construction on September 30th last, excluding warships, was 633,232, of which less than 5000 tons were of iron, timber, and composite.

It appears from the returns compiled by Lloyd's Register of Shipping that, excluding warships, no fewer than 355 vessels, of 659,641 tons gross, were under construction on 30th September last. This, however, is 57,000 tons less than at the corresponding date last year.

There was on the same day recently nine British war vessels under construction in Royal Dockyards, of 80,835 tons total displacement; and sixty British vessels, of 104,455 tons displacement, in private yards. Of foreign war vessels and those whose nationality is not stated, twenty-six were in course of building, having a total displacement of 82,740 tons.

The net output of the Nord and Pas-de-Calais coalfield during the first six months of the present year is 8,301,125 tons, against 7,766,393 tons during the first half of last year, showing an increase of 534,732 tons. Of the above quantities the Pas-de-Calais contributed 5,749,360 tons during the first half of the present year, against 5,314,647 tons during the first half of last year, showing an increase of 434,713 tons. The companies whose output shows the greatest advance are those of Fléchinelle with 57 per cent., Bully-Grenay with nearly 25 per cent., Bruay 19 per cent., Marles 11 per cent., Nœux 11 per cent., Lens 8·3 per cent., Ferfay nearly 7 per cent., and Dourges 6 per cent., in the Pas-de-Calais; and Douchy with 10½ per cent., Escarpelle with 8·2 per cent., and Aniche with 5 per cent., in the Nord. The number of winding shafts in operation is 99, the same as last year, showing a mean output of 97,000 tons in the Pas-de-Calais, and of 63,000 tons in the Nord, while the largest quantity put out, viz., 214,000 tons, was contributed by a shaft of the Bruay Colliery. In round numbers the half year's output of the northern coalfield has exceeded by 500,000 tons that during the corresponding period in 1894 and 1895. This result is attributed to the revival of trade.

In the course of his speech inaugurating the second International Congress of Applied Chemistry, Professor Berthelot observed that during the last twenty-five years chemistry has transformed the mining art by the methodical discovery of new explosives, by the rigorous, theoretical, and practical measure of their relative force, and by fixing the rules which should preside over their use. In the metallurgy of iron, steel, and gun metal also, methods and processes have been changed under the impulse of chemistry. To the metals known during the last 700 years are now added those of later date, discovered in laboratories, viz., nickel, aluminium, and tungsten, the future and possible destinations of which it would be presumptuous to limit. The methods by which the new and ancient metals are prepared are now undergoing unexpected changes under the influence of the united theory and practice of chemists and physicists. Electricity, which has given rise to more general and more radical changes in chemical methods, is now employed under two forms—electrolysis and electric heating—deduced alike from physical and chemical laws. Electrolysis works both by the wet and the dry way, the former having created electro-metallurgy, while the latter triumphs especially in the preparation of the metals. Finally, the electric furnace utilises in the production of metals and other alloys the combined effort of electric polarisations and the high temperatures, until lately unknown, which electricity now affords.

A paper recently read in America on heat conductivity, expansion, and fusibility of fire-brick, by Mr. J. D. Pennock, gives notes of experiments on bricks made of Greek and of American magnesite, silica brick, and coke oven tiling made in Belgium. The analyses of the respective materials were as follows:—Silica: Greek magnesite, 2·16; American magnesite, 3·10; silica brick, 94·07; coke oven tiling, 69·89. Iron oxides and alumina: Greek magnesite, 0·72; American magnesite, 6·64; silica brick, 3·66; coke oven tiling, 27·75. Calcium oxide: Greek magnesite, 4·20; American magnesite, 3·76; silica brick, 1·39; coke oven tiling, 0·27. Magnesium oxide: Greek magnesite, 93·03; American magnesite, 86·50: silica brick, 0·19; coke oven tiling, 0·17. The weights per cubic foot were for the Greek magnesite, 170·2 lb.; American magnesite, 160·9 lb.; silica brick, 111·4 lb.; coke oven tiling, 109·9 lb. In experimenting on heat conductivity, the different brick, showed after exposure in the furnace for five hours, starting at 25 deg., the following temperatures:—Greek magnesite, 337 deg.; American magnesite, 297 deg.; silica brick, 177 deg.; coke oven tiling, 154 deg. This shows the superior conducting power of the magnesite. The expansion per foot under high heat was for the Greek magnesite, 0·11in.; American magnesite, 0·088in. to 0·10in., coke oven tiling, 0·076in.

In a letter to the editor of *Nature* Prof. A. E. Munby says the cheap production of acetylene has come as a great boon, and is now in regular use for laboratory blow-pipe work. The apparatus in use consists of an aspirator holding about fifteen litres, permanently connected with a water supply, and possessing a ¼in. aperture exit tap—the water flows in from below to minimise absorption; at the top a three-hole rubber cork carries an upright pipe, passing through the table, which serves for filling the aspirator with gas or using the gas on the table, a second pipe goes to the blow-pipe, and a third carries an open mercury manometer. For filling the jar the calcium carbide is placed in a four-ounce bottle, closed by a cork carrying a small separating funnel from which the water drops; the gas passes to the aspirator through a wide glass tube, which acts as a reversed condenser, returning most of the water vapour to the bottle. With the large exit to the aspirator the gas can always be collected under a reduced pressure of several cms. of mercury, which quite provides against any sudden rushes of gas; the operation takes some ten minutes, and requires practically no attention. In using the gas the water is turned on with all taps closed for a few seconds, to correct any reduced pressure caused by absorption, as shown by the gauge—this is very slight indeed—and then the gas tap fully opened and the flame regulated entirely by the water entrance. To bring the gas into use takes hardly any longer than with an ordinary gas blow-pipe.

The *Revue Industrielle des Mines* publishes in a recent issue a detailed review of the iron works in South Rnssia. Not until 1890 were the first iron works erected by Hughes and Pastuchow. Since then there were erected in the direction from west to east. (1) The Krivoi Rog works consisting of 80 Coppée coke ovens and two blast furnaces; the works have paid an annual dividend of 5 per cent. for the last seven years. (2) The Dnieprovienne, consisting of four blast furnaces, four Martin furnaces and five puddling furnaces; this concern produced in 1894-5 102,000 tons at a value of 10,892 roubles, the net profit amounted to 3,650,000 roubles. (3) The iron works of Briansk, consisting of four blast furnaces, four Martin furnaces and 16 puddling furnaces; in 1893 the works paid a dividend of 10 per cent., in 1894, 22½ per cent. and in 1805, 30 per cent. (4) The Hughes works consisting of six blast furnaces, nine Siemens furnaces and 22 puddling furnaces; in 1895 it produced 171,000 tons of pig iron and payed a dividend of 25 per cent.; the Drujkowska works and Donetz steel works; the production in 1895 was 35,000 tons of pig iron, 25,000 tons of Bessemer billets and 20,000 tons of steel rails. To these the following new works have to be added: (1) The Russo-Belgian Iron Company, 120 coke ovens, two blast furnaces, two Martin furnaces and 20 puddling furnaces. (2) The Touriefka iron works, two blast furnaces, steel works and rolling mills. (3) The Olkhoval Company, a branch of the Belgian blast furnace concern Habianzy. (4) The Russian steel works at Lugansk. (5) The Belgian works at Taganrog, two blast furnaces, Siemens-Martin steel works, puddling works and sheet mills.

MISCELLANEA.

We have received a prospectus of the day and evening classes at the King's College, London, for the session 1896-97.

Palmer's Shipbuilding and Iron Co. have, at Jarrow, commenced the manufacture of bicycles, and it is their intention to exhibit thirty of their machines at the Stanley show. They are preparing to go in largely for the motor car manufacture.

The exhibition at the offices of the London Chamber of Commerce, Eastcheap, of samples of foreign goods which compete with British production in the colony of Victoria will, so far as the day exhibition—11 a.m. to 4 p.m.—is concerned, close to-morrow—Saturday—at 1 p.m., but the samples will be open for inspection by workmen between the hours of 7 p.m. and 10 p.m. on each evening from October 5th to October 9th.

The first meeting of the committee formed for the purpose of promoting the International Submarine Telegraph Memorial will be held in Room 174, Winchester House, Old Broad-street, London, E.C., on Tuesday next, October 6th, at 2 30 p.m. An executive committee will then be appointed, and it is expected that Lord Kelvin will explain his views as to the most appropriate object to which the bulk of the fund should be devoted.

In these days of keen competition between home manufacturers and their continental rivals, it is a source of satisfaction to learn that in 1894—the last year for which the complete figures are available—the United Kingdom supplied 23·7 per cent. of the total imports into Russia. The proportion has remained very steady since 1888. In that year it was 25·9; in 1889, 23; in 1891, 21·9; in 1892, 25; in 1893, 25·5, so that, says Mr. Michell, our Consul-General at St. Petersburg, in spite of fluctuations in amounts, German competition, and Russian protective legislation, British imports maintain their position, and in 1894 were higher in absolute values than for many years previously.

A remarkable instance of the enormous force of the wind during the recent gale occurred at Dover. A Goliath crane, weighing over one hundred tons, which is used on Sir John Jackson's new harbour works, was blown bodily over, and lies on its side on the breakwater, which prevented its fall into the sea. The crane was caught by a squall, which snapped the chains that held it, and drove it along the rails until it reached the end of the pier. In its fall the crane smashed the wooden pile work, and as it crashed on to the stone breakwater the boiler exploded with a loud report, which was heard for a considerable distance. Most fortunately there were no workmen near at the time. The damage is estimated at a considerable sum.

The official traffic returns for the North Sea and Baltic Canal during the first working year are as follows:—7531 steamers, of which 642 belonged to regular lines, have passed through the canal. 266 German and two foreign war vessels also made use of the waterway. The sailing ships numbered 9303, of which 8477 were German. Among the ships belonging to other nationalities were 3 Belgian, 164 English, 547 Danish, 6 French, 63 Dutch, 30 Norwegian, 174 Swedish, and 56 Russian steamers; while the sailing vessels included 20 English, 265 Danish, 2 French, 318 Dutch, 30 Norwegian, 162 Swedish, and 28 Russian. The total receipts from steamships amounted to 680,825 marks, and from sailing vessels to 216,626 marks, making a total revenue of 897,451 marks—a sum, says the *Times* correspondent, which falls far short of the official estimate of 5,000,000 marks.

The whole of the electric light installation at the new Trocadero Restaurant has been carried out by Messrs. Strode and Co., 48, Osnaburgh-street, Regent's Park. A new system of wiring, called the "new conduit" system, has been used in this building, the whole of the cables and wires being drawn into specially prepared wrought iron tubes, insulated inside, and screwed together, and arranged with inspection boxes in convenient positions, so that the whole of the cables and wires can be drawn into the tubes after they are fixed, and can be withdrawn at any future time for inspection. The advantage of this system is that the whole of the tubing of the building can be done during the progress of building, thus avoiding any unnecessary cutting away. The cables and wires need not be drawn in until the building is nearly completed, thus avoiding all chance of mechanical injury, or damage by damp.

The result of the ballot which was taken on Tuesday night upon the question of whether or not the men engaged in the iron trades in the Manchester district should withdraw from their work on Saturday next unless the masters granted the advance of 2s. per week asked for in the circular of the 25th of August was published on Wednesday, it was found that, as 4543 of the men had voted in favour and only 272 against a strike, the question assumed more serious proportions. Should no means be discovered of bringing the parties together before Saturday, and inducing them to accept a compromise, 8000 men will be thrown out of work.—The negotiations during the last couple of days on the Manchester engineers' wages' question resulted in a conference between representatives of the employers and workmen being held to-day—Thursday—in Manchester. The proceedings were not concluded when we went to press, but it is expected that an amicable arrangement will be come to before the close of the week. Any decision, however, will have to be submitted to subsequent meetings of employers and workmen.

The Vice-Consul of Tunis suggests that British merchants should turn their attention to that country; its trade is open to all on equal terms, and it is a pity that an important new market should be neglected in these days, when new markets are few. He mentions especially the trade in metal goods as one likely to repay attention. British machinery has a good name in Tunis, and is rarely found there, although there is a great demand for machinery with the increasing industries, such as oil mills and presses, which are being erected in great numbers, and require extensive plant of a kind manufactured in England. Again, the Vice-Consul frequently hears the wish expressed for a good English knife, but one is not to be had, and so it is with a long list of articles, of which there are worthless imitations in abundance because of the indifference of the manufacturers of the genuine ones. Formerly it militated against British trade that there was no direct shipping, but now vessels go every ten days from Manchester, while there is a monthly service between London and Tunis, and thus goods which cost much for carriage, and took twenty to twenty-five days, now go cheaply and in just half the time, a consideration which is much appreciated locally.

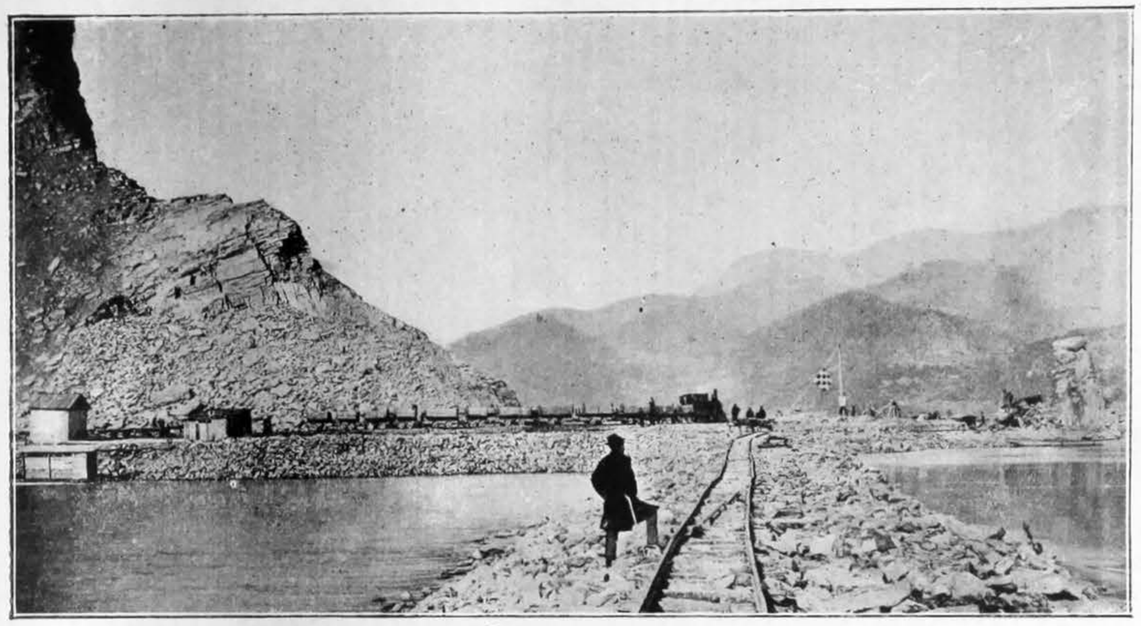
The report of the Canal Commission which has been considering the proposal to unite New York and Philadelphia by a ship canal has just been issued in pamphlet form. Two surveys, it appears, were made by the direction of the Commission, but by either route vessels would use the Delaware River from Philadelphia to Bordentown. Thence a canal would be cut across New Jersey, entering the sea at Sandy Hook. The distance between the two cities would thus be reduced from 274 miles to 92 miles, of which 31½ miles would represent the canal. It is estimated that the canal, if 150ft. wide and 20ft. deep, would cost £2,852,920, or £4,778,940 if 184ft. wide and 28ft. deep. In the first case an additional sum of £187,172 would be required to deepen the river approaches to the canal, or £625,140 to obtain a 28ft. channel. The surface of the canal would be 58ft. above sea level, and there would be three locks at each end. The soil to be excavated consists of sand, gravel, and clay. Steaming at 10 miles an hour, a vessel going by Cape May and the ocean takes 27½ hours; by the new route, if allowance be made for diminished speed up the canal and delays in passing the locks, the time occupied is put at 15 hours.

VIEWS OF THE WORKS FOR THE REGULATION OF THE DANUBE

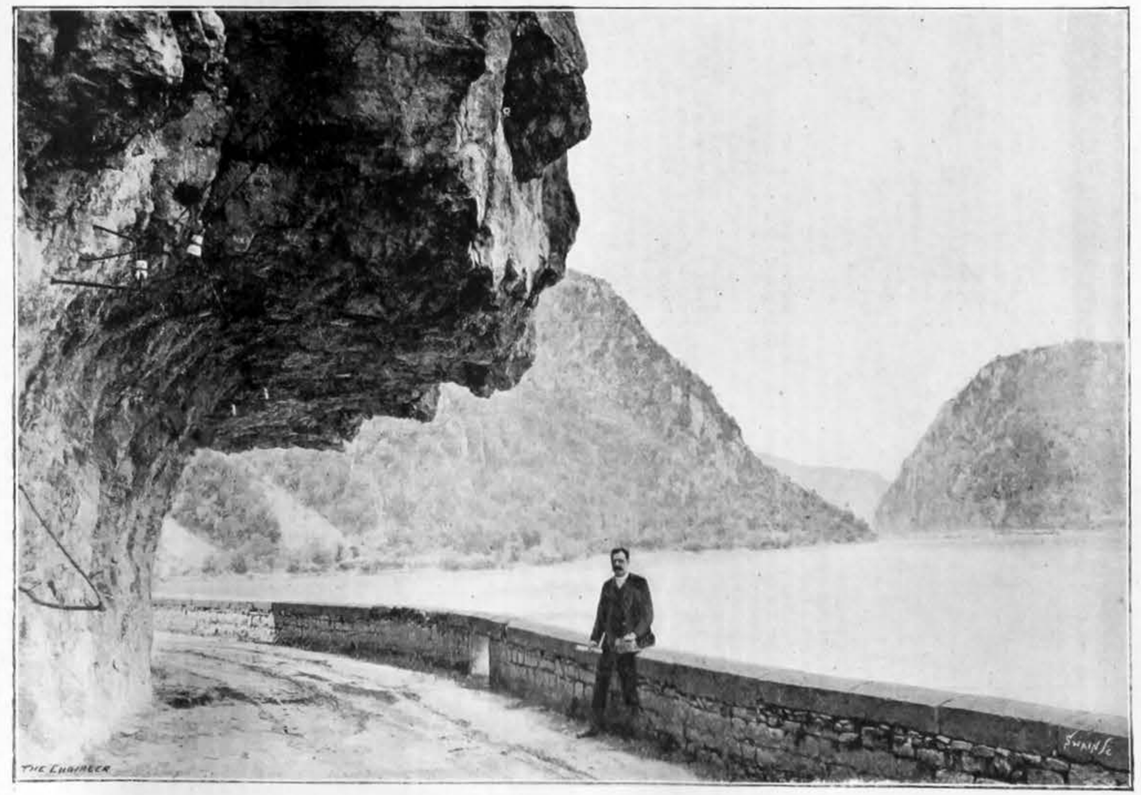
(*For description see page* 335)

EXCAVATION OF THE CANAL THROUGH THE ROCKS OF THE IRON GATES

THE GREBEN TIP OF THE HONE DAM AND TRAINING WALL—LOWER GREBEN



THE TABLE OF TRAJAN IN THE STRAITS OF KAZAN



THE PASSAGE OF KAZAN WITH THE "SZECHENYI" WAY

PUBLISHER'S NOTICE.

*** *With this week's number is issued as a Supplement a Two-page Engraving of the Triple-Expansion Engines of H.M.S. Powerful. Every copy as issued by the Publisher includes a copy of this Supplement, and subscribers are requested to notify the fact should they not receive it. Price 6d.*

CONTENTS.

TO CORRESPONDENTS.

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

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

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

REPLIES.

G. C. O. W. (Newport, Mon.)—(1) Fans are so numerous in form and efficiency that it is impossible to give you a general formula. See Clark's "Rules, Tables and Data for Mechanical Engineers." (2) Yes, the exhaust may be led through large thin cast iron pipes, such as greenhouse pipes for long distances, without materially affecting the back pressure. A vacuum can only be obtained by some form of condenser.

A. B. C.—A coiled spring could be used for the purpose of lowering weights as you propose. But the equivalent of the fusee and chain of a watch would have to be employed in order to equalise the tension. There are no data available to determine the dimensions of the spring, because the conditions admit of various combinations. Generally we may say that the spring when fully coiled should be one-half the diameter of the uncoiled spring, and that three and a-half complete turns are the greatest number that can be used without risk to the spring.

Besoin (Birmingham.).—In the first place you cannot do better, we think, than to go to the reading room at your public library and consult there the foreign technical journals, which we presume are available. From them you can obtain much useful information concerning the methods of expression, words, and idioms employed by French, German, and Spanish writers. You can also in many cases obtain catalogues on application to firms advertising, but you must remember that foreign firms do not use catalogues in the lavish way adopted by English and American firms.

J. M. and Sons, Ltd.—For English, German, and French languages we can recommend Karmarsch, of Wiesbaden. Messrs. Sampson, Low, Marston, and Co., London, are the agents for Tolhausen's English-German-French Technological Dictionary, which is also a good one. For Spanish N. Ponce de Leon, two vols., the agents in England being Messrs. Whittaker and Co. A French-Russian German-English Dictionary, by Andrieff, is published in St. Petersburg; and a German-English French-Italian Dictionary by Offinger, is published by the J. B. Metzlersche Verlag, Stuttgart.

G. A. H. (Penithon.)—The old water-tube boiler to which you refer was a complete failure at sea. It was made the subject of very costly and extended experiment. It was impossible to put anything like the boiler pressure into the engines, as without excessive wire-drawing the steam was mixed at one time with almost its own weight of water, at others it was so dry and superheated that it burned the packings out. The production of really clean dry steam is a far more difficult matter than you think. If you will make a drawing of a coil boiler on your principle, with about 5000 square feet of surface, you will soon begin to form a faint conception of the practical difficulties to be overcome. The Patent-office is full of the records of wasted efforts in this direction.

INQUIRIES.

JACKSON, BEAN, AND GOW.

Sir,—Would any of your correspondents kindly let me know the various works the late Mr. William Bean and the late Mr. James Gow Stuart, of the firm Jackson, Bean, and Gow, carried on. Any information of the above will be gratefully received. H. F. S. B.
Lee, Kent, S.E.

MEETINGS NEXT WEEK.

The Glasgow and West of Scotland Technical College.—Thursday, October 8th, at 8 p.m.: Lecture, "Best Yorkshire Iron, and How it is Made," by Mr. E. Windsor Richards.

London Association of Foremen Engineers and Draughtsmen.—Saturday, October 3rd, at 8 p.m.: Paper, "Explosions of Steam Generators and Accessories," by Mr. John Batey, of Dublin.

Society of Engineers.—Monday, October 5th, at 7.30 p.m.: Paper to be read, "Discharging and Storing Grain," by Mr. William G. Wales, Assoc. M. Inst. C.E. Synopsis:—Importation of wheat and other cereals in the United Kingdom—Home produce of wheat—Various systems of discharging grain from ships—Use of hydraulic cranes and tubs or Priestman buckets—Floating grain elevators—Fixed elevators—Portable elevators—Pneumatic and compressed air grain elevators—Cost of various systems and relative advantages—Granaries—American system of storage—Construction of silo granaries—Comparative cost of silo and floor granaries—Comparative storage capacity of ditto—Machinery for the conveyance of grain in warehouses.

THE ENGINEER.

OCTOBER 2, 1896.

GAUGE GLASSES IN THE NAVY.

The court-martial on Fleet-engineer Henry Burner and Engineer G. E. A. Crichton, held at Devonport, presents certain points not without interest. H.M.S. Blake, returning from a foreign station, underwent, as is usual, a refit, and was then taken out for the regulation steam trials. During these, two boilers gave way, the crown of the combustion chamber of one cracked, and so much leakage took place that a stoker was scalded to death. It was asserted that the engineers on watch, whose names we have given above, were responsible, that the accident was caused by shortness of water, and a coroner's jury took the same view. This proceeding in the civil courts has not prevented the holding of a court-martial. But it may be that the finding of the court will not be without its effect so far as the Treasury is concerned. The charge that the officers did not exercise proper supervision over the working of the gauges was held not to have been proved, but the court found that sufficient supervision had not been given to the replacement of the gauge glasses. Under the circumstances it is of course impossible for us to pronounce any opinion on the merits of the case, and we must content ourselves with directing attention to some of the points raised during the court-martial, and the evidence given.

The first line of defence is that, although overheating took place, that was not the fault of the gauge glasses. The Blake's boilers are of the double-ended single combustion chamber type, to all intents and purposes condemned as quite unsuitable for forced draught; and it is asserted, and was admitted by one of the witnesses, that the Blake's boilers had given trouble in the usual way, the tubes leaking in the combustion chambers. It was also admitted that although no special defect existed in the gauge glass of No. 2 boiler, it had suffered from overheating. Fleet-engineer Robert Mayston, Chief-engineer of Devonport Dockyard, deposed to having examined Nos. 2 and 3 boilers of the Blake, subsequent to the accident. Both boilers were clean; but the tops of the combustion chambers were considerably distorted, and in No. 3 boiler the after tube plate was twisted on the upper flange. Mr. Butler, chief-engineer, and inspector of machinery, said that as far as the damage to No. 3 boiler was concerned, it was caused by shortness of water due to the defective condition of the gauge glasses; but as to the cause of the damage to No. 2 boiler, he could not speak positively. The prosecution contend that all or nearly all the gauge glasses in the Blake were untrustworthy, because they were all more or less choked by the india-rubber packing rings; and it is contended that the gauge tubes had been improperly packed, and that this neglect was the cause of the accident. It is, of course, not for us at this stage of the inquiry to say whether the condition of the gauge glasses did or did not manifest neglect. It was explained, however, that the use of india-rubber packing rings had recently been abandoned in the Navy in favour of asbestos. Every engineer who has had any experience with gauge glasses knows that if the glass is a little too short, the india-rubber rings are liable to work up and get nipped between the end of the glass and the brass socket, and the rubber may and sometimes does get across the end of the glass and practically choke it. As we have stated, a new standard type of water gauge fitting is being introduced. Mr. Butler stated in cross-examination that the new gauges were now being fitted to the Blake's boilers. The improvements in the new pattern glasses "comprised a deeper recess, which, no doubt, would lessen the risk of chokage from imperfect packing. India-rubber exercised some chemical and corrosive action upon glass such as was used for gauge glasses, and one of the gauge glasses of No. 6 boiler, packed with india-rubber, was corroded. Personally he did not like india-rubber for gauge glasses subjected to high-pressure steam. When heated, india-rubber became plastic, and if by any means a film of rubber got under the edge of the gauge glass, it would be forced progressively within the circumference of the glass, and this would take longer to occur with the new fittings than with the old."

It appears to us to be a little remarkable that a ship should be permitted to go on steam trials with all her gauges in a defective condition. The fact, if it be a fact, is very suggestive. It seems to us to be quite possible that the engineers in charge noticed nothing unusual about the glasses. They packed them just as they had been packed a dozen times before. It is tolerably certain that every one, down to the youngest stoker in the fire rooms, knew that a lying gauge glass might mean a dreadful death. It is difficult, therefore, to account for any neglect on the part of those in charge. The prominent fact, so far, is that the Admiralty have now condemned a type of gauge which it is to be supposed has done good service for many years. We know that a standard gauge has always been in use, and that contractors have always had to use it. We have, indeed, seen a gauge suitable for a boiler 12ft. in diameter, with end plates 1in. thick, fitted to little launch boilers so small that a couple of men could lift them. We have thus the curious dilemma placed before us. On the one hand, the Blake was fitted with gauges of a kind held for years to be the best possible—for only the best is supposed to get into the Navy; and, on the other, it appears from the evidence that nearly all the gauges were partially blocked up; and we have no evidence to prove that this state of affairs was quite unprecedented and abnormal, and every reason to believe that the usual amount of care had been taken in packing the glasses. How are we to reconcile the assumption that gauges of defective construction would not be passed into service when the fact that not one but a number of gauges on board the Blake could show false water? It would be a slur on the intelligence of our readers to explain in detail that if gauge fittings are properly made the choking of the tube by the packing is physically impossible.

THE CONDITION OF THE STREETS.

Those whose fate it is to traverse the distance between Charing Cross and St. Paul's day by day have excellent reason to doubt the advantages of town life, and to ask is it not possible that something may be done to preserve to well-meaning pedestrians that right of way for the enjoyment of which, in theory, they pay so heavily in practice. In no other city under the sun, we believe, would an intolerable condition of affairs be permitted to exist continuously. The ripping up of the footways is in no sense sporadic; it is not a thing of the instant; a passing effort to achieve a possibly desirable end at the cost of a momentary evil. On the contrary, the ripping up and the blocking of the footways seems to be the normal condition. Fleet-street and the East Strand are just now suffering most heavily, but matters are little better in other parts of London.

Under proper urban conditions, we have asphalte footways bordered by stone kerbs, and provided with "coal plates" giving access to cellars under the footway. These footways are, however, too narrow as it is for the great stream of traffic moving East and West along Fleet-street. These dimensions are, moreover, continually reduced by the erection of hoardings for building purposes. These are thrust out into the street. In some cases they occupy the whole width of the footway, and then a narrow space is taken from the roadway, and railed off for foot passengers. In others the carriage road is already too narrow, and a passage about 2ft. 6in. wide is left on the *trottoir* to provide for the movement of the multitude. Many years' experience tells us that building operations are always going on in Fleet-street and the Strand; and it also tells us, that no attempt whatever is made to expedite work, and that the last thing thought of by the authorities is the convenience of the public. There is an aspect of this question which does not receive adequate attention. The hoardings are a direct source of gain, and that on so considerable a scale that it pays well to keep the hoardings at the service of the advertiser as long as possible. In a case which came not long since under our notice in a leading thoroughfare north of Oxford-street three houses of moderate dimensions were being built. Operations were interrupted by a strike, which the con-

tractor and all concerned took very coolly. On inquiry we found that the rent of the three houses would be £600 a year, from which would be deducted rates and taxes and the cost of repairs. But the hoardings were bringing in quite £600 per annum from advertising firms. In a word, the hoardings were a far better property than the houses which they surrounded would be. No doubt the advertising element plays an important part in settling the size of the hoarding and the time it shall stand. If all such structures were treated as they are abroad, brought under strict police supervision, while every sheet of advertisements had to bear a Government tax, something would be done to mitigate a considerable nuisance. But, furthermore, a little judicious exercise of authority might prevent continuous building operations. Why should not half-a-dozen houses be rebuilt at once, instead of prolonging the work for years, by rebuilding one house at a time? We believe that in certain cities of the United States this plan is adopted, and no building operations in any given street are permitted except during pre-arranged periods. Thus, while building is proceeding in 45th street, let us say, the streets on either side must be left undisturbed.

But the rebuilding of London in a piecemeal, half-hearted way, is not the worst evil. Let us consider what lies under our footways. We have all the gas and water service pipes. We have the mains supplying the fire hydrants, and those of the hydraulic power company; the pipes for the pneumatic dispatch; the electric wires of the Post-office; a considerable proportion of telephone wires; and the electric light cables of a couple of companies. All, or nearly all, these have cast iron manholes, and these are so numerous, and the footways so narrow, that probably 20 per cent. of the surface in Fleet-street is made up of the iron lids of these boxes. Numerous as they are, however, they do not suffice, and not a week passes without the asphalte being broken up by some one who wishes to get at a cable, or a pipe, or a wire below. It is very questionable if asphalte is the proper material for a footway under the circumstances, because it is impossible, once broken up, to relay it in a hurry. The trench is cut with much labour in the concrete. The pipe, &c., is laid or renewed, or the cable is repaired. Then the cavity is filled in with loose stuff which gets a perfunctory ramming, and is left to settle. In a week the surface of the filling is removed, and the space made up with cement concrete protected by planks. This is left to set, and finally the Italians come along and lay the asphalte, rendering the street unendurable with suffocating fumes for hours. The whole operation means the ruin of the footway for a fortnight; and the work has been scarcely completed when a parallel line is ripped up by someone else. And this is always going on. It is purely exceptional to find the footways in Fleet-street left unmolested for a fortnight.

Now, we feel certain that there is bad management, growing daily worse, to account for these things. We are quite ready to admit that there are difficulties to be overcome by the authorities, but we should be well satisfied if we saw that sensible, reasonable efforts were made to overcome them. We have no doubt that there would be less ripping up of streets if obstacles were thrown in the way by the authorities. They are not in the United States one-half as particular as we are, but even there the municipal worm is beginning to turn. The cost of all the ripping up and repairing work is being made extremely heavy. New York charges 16s. per square yard for opening an asphalte pavement, with a minimum charge of £3 4s., and £1 12s. for the first square yard of granite pavement, and half that sum for every succeeding square yard. The City of Philadelphia charges £2 12s. for permission to open an asphalte pavement in summer, besides all the charges for renewal, and £3 12s. between December 1st and March 1st. In this way it is hoped that something will be gained, and that the footways will not be ripped up without due cause. Householders, for example, are likely to be very careful in the matter of service pipes, if they know that it will cost from 8 dols. to 16 dols. merely to get at the pipe in case of a leak or other failure.

At various times it has been suggested that subways should be made in our streets to carry water and gas mains, &c., and the suggestion has been partially carried into practice. It is difficult to do it in old and narrow streets, but there would be no insuperable difficulty of this kind, nor would the cost be very great of laying under the footway of any and every street a cast iron trough, 4ft. wide and 2ft. deep, in which could be stowed with the utmost ease all the various pipes and cables now covered by asphalte. The trough could be covered either with chequer plates or with stone or asphalte blocks in frames. It would be waste of time to dwell on the advantages to be obtained. The objections are scarce worth mentioning. Induction, for example, can do more harm when cables and wires lie in a box than it can when they lie side by side in gas-sodden earth. The service pipes would give no more trouble than they do now. The interest on a very large outlay would be paid by the saving effected in the cost of getting at the pipes and cables. The engineering difficulties are nothing, and the comfort of the foot passengers would be immensely promoted. It seems to be almost impossible that things can go on much longer as they are without a public expression of feeling which may astonish the City authorities, and the remedy we suggest is on the whole not only perfectly feasible but literally quite unobjectionable.

THE METROPOLITAN RAILWAY OF PARIS.

It is just possible that were our Parisian neighbours so fully acquainted as ourselves with the numerous disagreeable features attending subterranean railway travelling they would not be so anxious to construct their new project upon lines closely resembling those of our own Metropolitan. Authorities and parties in France interested differ—as will be presently indicated—respecting the best means to achieve the end in view, but they appear to be unanimous in the opinion that the desired goal should be attained in one way or another. It is the Municipal Council of Paris that has proposed a scheme for a Metropolitan Railway, which our professional contemporaries regard with marked disfavour. It has been wittily observed that the chief *raison d'être* of the Municipal scheme is to prevent the Parisians from leaving their capital. Granted, but on the other hand, if the inhabitants are deprived of the means of egress, those living in the suburban districts will be equally destitute of the proper facilities for ingress. It is exceedingly doubtful whether in the long run the results of a project so purely centralised would be to the benefit of the great focus of centralisation, that is, the metropolis itself. It may be remarked, without entering into unnecessary details, that a small portion of a metropolitan system exists already in Paris, such as the *ligne de Ceinture*, and the western suburban line. The objections raised against the system proposed by the Municipal Council—which in the main we agree with—are, first, that it completely cuts off the possibility of any interchange of goods traffic between those existing lines already referred to, and those of the future, by the adoption of a different gauge. This is a grave error, although we cannot enter upon another "battle of the gauges" to support our contention. Secondly, it is pointed out that all communication between the existing railway stations and those pertaining to the new line will be of a very troublesome and unsatisfactory character. Again, it is alleged that the scheme will be hopelessly inoperative as a means of supplying the capital with provisions, and that, consequently, it will be practically useless for the purposes of defence and mobilisation. These are very serious allegations, and it will be interesting briefly to consider the grounds upon which they are based.

It is some forty years since the first scheme for a metropolitan railway in Paris was brought to public notice. Since that period numerous tentative projects have been submitted to the authorities for approval, but one by one they have all succumbed to the insuperable difficulty of reconciling the conflicting interests of the metropolis in particular, and of the State in general. While, therefore, the French Government has always regarded the proposed metropolitan as a railway possessing national claims, and not to be conceded to the City of Paris as a monopoly, it is doubtful whether it would now hold unconditionally to that opinion. Thus encouraged, the Municipality has put forward a scheme for a line of narrow gauge, which isolates it alike from all the present stations and all future lines adopting the recognised width of track. It appears rather an extraordinary proceeding, but what the Municipality of Paris really intends, is to have a railway entirely within its own jurisdiction, under its sole control, and disconnected from all other existing lines. To ensure this condition of unenviable autonomy and isolation, it has clinched the question by a break of gauge. In an engineering point of view—digressing for a moment—there are no objectionable features in connection with the proposed project, apart from those which inevitably accompany all underground tracks. The sharpest curve does not radiate less than 250ft., and the steepest gradient does not exceed one in sixty. Except that the general cross section of the proposed new line, whether in tunnel, cutting, or station, does not differ much in unsightliness from our own, there is little to choose between them. The usual object of the promoters of new lines of railway is to place them *en rapport* with their predecessors, and so far the French engineers have adhered to that self-evident principle, whether the intercommunication was city, suburban, or rural. The Municipal Council of Paris has violated this principle, in fear lest the population should abandon the city to dwell in the environs. It is suggested that this enforced isolation on the part of the Council may be due—we do not assert to a hostility—but to an opposition to the great railway companies of the capital. In a different department of important public works, our readers will recognise a somewhat recent similar manifestation in our own metropolis. The attempt to justify the break of gauge on the score of economy, both with respect to first cost and subsequent expense of maintenance, is unworthy of the guardians of so great a capital as Paris. The adoption of a metre gauge, even admitting the economy in the first cost, which our own experience has taught us, is more apparent than real in crowded cities, defeats the very object for which a metropolitan railway should be designed. Its capabilities will not suffice for the demands made upon its resources, and in a word, it will not be remunerative. It is satisfactory to notice that whatever project may ultimately be carried out, there is a universal consensus on one point, and that is that the mode of traction or haulage should be electrical. We might ourselves take a hint on this point from our friends on the other side of the Channel.

NORTH BRITISH RAILWAY WORKS.

The North British Railway Company is making rapid progress with some of the great lines and works it has in course of construction. In the last six months it spent £414,254 of additional capital, and of this sum about £175,159 was spent on the lines and works that are open for traffic; £35,510 on the lines and works in course of construction; and £155,211 on additional working stock. Of the expenditure on the lines and works that are open for traffic, the largest item was that of the Waverley Station and the widening of the lines there, which took £110,652 in the six months. Of works in course of construction, Methil Harbour took £40,291; and of the working stock expenditure the largest sum was that for wagons, which claimed seven-eighths of the total. In the half-year that has now begun, the anticipated capital expenditure is about £340,380, and more than a quarter of this is on the Waverley lines widening and works, whilst the Methil Harbour works take up £40,000, and about £50,160 are to be expended on additional working stock. It is to be noticed that the revenue of the North British continues to enlarge—it rose £100,000 in the last six months, and that though the working expenses for the period displayed a slight tendency to rise, they were still 47·11 per cent. of the traffic receipts—a percentage that is far below that of many of the great lines of England. The company has now under construction, or to be constructed, some 34½ miles of line, so that there is still before it considerable work for the engineer, and as there remains to be expended after the end of this year a very large sum on capital account, including about £888,000 on the Waverley works, it will be seen that it has before it some constructional work of moment. The condition of the commerce of two of the great centres of trade that the railway serves is satisfactory, and though the mineral trades have to contend with very low prices, they have the advantage of cheaper working than those of perhaps any other district in the United Kingdom. It may fairly be hoped that there is before the Scotch railways a period of prosperity that will enable them to complete their great works in hand, and to allow the traffic that these should bring to grow so as to give to the enlarged capital a better yield than is now obtained. There is at present all the indication that this is likely to be the case, unless there should be some labour interruption that is not yet evident.

THE TERRIBLE.

A comparison of this great vessel with her immediate predecessor in the British fleet most forcibly illustrates the advance in naval matters during the last half century. In February, 1845, what was then considered one of the finest war steamers in the world was launched at Deptford, under the name of Terrible. A wooden paddle-wheel vessel, her extreme length over all was 253ft. 9in.; breadth, 42½ft.; tons measurement, 1847. Messrs. Maudslay and Co. had contracted to supply her with engines of 800 nominal horse-power at the cost of £41,250. The weight of engines is given at 212 tons; of boilers, 250; water in boilers, 138; paddles, 44 tons; coal-boxes—doubtless bunkers are meant—16 tons; making a total of 660 tons for steam machinery. The length of engine-room, which doubtless included that of stokehold and bunkers, was 76ft. 7in.; breadth, 38ft.; depth, 27ft. 4in.; diameter of paddle-wheels, 34ft., with a width of 13ft.; and four cylinders 6ft. diameter; Siamese engine; weight of coal carried, 800 tons. Her first armament seems to have consisted of twenty guns, the heaviest 95 cwt., throwing a 68 lb. round shot, or a shell of less weight. Her complement of officers and men was 240. Her first trial trip was in the spring of 1846, when, with a draught of 18ft. 11½in. aft, she attained a speed of 11 knots an hour. She resembled her successor in one point, viz., she had four funnels, though some time later they were reduced to two, otherwise a comparison of this first-class cruiser of 1846 with that of 1896 shows that the latter has more than double the length, 28ft. more beam, and well-nigh 50 per cent. more draught. Displacement probably four times as great, and at least tenfold engine power, which gives about double the speed; while as to armament, the new vessel's largest shells are quadruple the weight of any ever used by the old; and even that statement but faintly expresses the advance in other respects. Nevertheless, the old steamer did good work in her day. She took active part in the bombardment of Odessa and other operations in the Black Sea during the Russian war of 1854-55, and, after various services, one of her last was to assist, in 1869, in towing the great Government floating dock to Bermuda. She did not disappear from the Navy List till 1876. In wishing success to her new namesake, we can only say that if she serves the nation for as long a period, and with the same good fortune, there will be no just reason to complain.

MACHINERY WINS.

"Superstitions," we are told, "die hard." A lamentably lingering death has been the fate of the manufacturing fallacy that files can be better made by hand than by machinery. But it is dead at last—"Dead as a door-nail." The last screw in the coffin of this industrial superstition has been turned by the Government, for specifications from an important Government department are now in the hands of certain firms of file manufacturers in Sheffield, in which occurs the stipulation that they are to be machine-cut. This is understood to be the first time that any tender emanating from the Government has contained such a proviso, and it has excited a good deal of interest and comment in the trade. Moreover, since the men employed by the hand-cutting firms obtained a 10 per cent. advance on their wages, these firms say they have been at a disadvantage in competing with those who use the machine, and whose men got no advance. Some have since adopted machinery, and others are saying that they must now come to it, or they will be shut out from securing Government and other contracts. So thoroughly does machinery seem to have taken possession of the file-makers that the orders which they have given out to engineers for the requisite machinery are actually exceeding the capacity of the workshops to supply. Taking advantage of the inability of English engineers to fill all the demand, the Germans are now introducing file-cutting machines into Sheffield, and are trying to obtain orders. This is certainly a remarkable fact. Yet it is not a little gratifying that at the very same time that this is going on, German file manufacturers are themselves purchasing freely from the Sheffield engineering firms file-grinding machines as well as machines for whetting chisels for use in file-cutting machines.

LITERATURE.

[concluding notice.]

Submarine Cable Laying and Repairing. By H. D. Wilkinson, M.I.E.E. *The Electrician* Printing and Publishing Company, Limited, Salisbury-court, Fleet-street, E.C.

We shall now turn to that part of the book which has reference to the laying of a cable. Provided that previous surveys have been made such as enable a suitable type, electrically and mechanically, to be designed and the required length made, no further soundings are necessary until the laying ship and her consort—if there be one—arrives at the field of action.

Mr. Wilkinson well describes all the implements employed in submarine survey—*i.e.*, the pianoforte steel wire; the different forms of detachable sinkers, with specimen tubes, varying for different depths; the apparatus for paying out and recovering the sounding wire; besides various sorts of thermometers for registering the bottom temperature. Amongst the sounding machines of the present day, the steam gear of Messrs. Johnson and

Phillips—Fig. 188—is, for surveying great depths, probably the most satisfactory; whilst for shallower waters the hand machine—page 339—of Mr. F. R. Lucas, has done exceedingly useful work. The author gives a description of a machine—illustrated on pages 335 and 336—which has since been very much improved on by the Silvertown Company. Some parts of this chapter do not appear to be based on quite the latest information, particularly as regards the instructions relative to the Johnson and Phillips machine. For instance, the wire is now supplied in lengths of as much as 7000 fathoms, thus rendering splices, for all depths so far experienced, quite unnecessary. Again, any such system as that originally suggested by Lord Kelvin, of balancing the weight of wire outboard by weights added to the brake as the wire is paid out, so as to provide for the stoppage of the wire drum immediately the sinker reaches the bottom, has for some time been abolished. It is found, indeed, that, provided the sinker has sufficient weight in proportion to the depth, it will descend at a rate which will in itself ensure the moment of striking bottom being immediately observed. Thus, as a result, it is no longer necessary for the drum which supports the wire to be particularly light; in fact, now-a-days, it is usually made of a character which permits the wire to be coiled direct on to it without any misgivings of its being thereby subjected to too heavy a strain. Similarly, it is more the custom at the present time to place the drum well inboard—rather than as in Fig. 183—even when paying out, thus providing for a good length of wire between it and the ship's stern. Buchanan's mercury and water piezometers, as well as other such instruments, receive admirable notice in this part of the book. The author has apparently made some use—duly acknowledged—of the paper on the subject of "Deep Sea Soundings," read by Mr. Edward Stallibrass some years ago before the Institution of Electrical Engineers.

We hardly expected to see detailed references to logs in a book on cable work, but their inclusion is highly suitable. The excellent and ingenious system devised by Lieut. Anthony Thomson, R.N.R., is fully described; but Mr. Wilkinson would have done well to point out some important advantages in its application to cable and sounding operations over logs as ordinarily towed, viz.:—(1) It does not require hauling in when stopping the ship; (2) that, owing to it being supported and kept in the water at a horizontal line, it registers correctly at quite slow speeds. The author then gives an exhaustive account of James's Submarine Sentry; though, again, very misplaced where it is.

Let us now revert to the course of operations more directly associated with the laying of a cable. To begin with, Mr. Wilkinson has admirably described and illustrated the different ways of landing the shore end. The figure on page 317 is in illustration of the plan invariably adopted by the Silvertown Company, and is well suited where a heavy surf has to be contended with, or in instances where no lighter is available. Here the cable, drawn on to by a line attached to the ship's picking-up gear, is floated ashore by means of balloon buoys introduced by Mr. Robert Gray for the purpose, in place of casks as first used by that experienced cable engineer, Mr. F. C. Webb, M. Inst. C.E. Under ordinary circumstances, however, most authorities consider the lighter system preferable, provided that the necessary plant is at hand.

In dealing with the gear for paying out, Mr. Wilkinson has furnished us with a general view—Fig. 201—of the machinery designed by the late Sir Charles Bright. The author then proceeds to describe and illustrate one part of this apparatus, *i.e.*, the segment table. This was introduced as a means of checking the cable's egress at a moment's notice, in the case of sudden necessity, and has on various critical occasions proved invaluable on the ships to which it has since been fitted. Mr. Wilkinson does well in pointing to the evils of V wheels. When laying a long length in a tropical climate, the V is liable to get clogged with compound to such an extent that the cable slips off. As with the V wheel, the unavoidable fleeting knife of a cable drum is shown in another part of the book. Useful work would be done by the mechanical engineer who introduced some other means of holding the cable in check during paying out than by the ordinary friction brake—say, by a brake based on hydraulic principles—as well as something to replace the fleeting knife, for preventing the fresh turn over-riding. Much has already been done by mechanical engineers to perfect the easy carrying out of cable operations; but a departure of the description indicated would be a further and great step in the right direction. Such a reform would be especially to the point just now, in view of the possible Pacific cable with a section of great length in extreme depths; and also on account of the recent tendency towards heavy cores which involve an increased weight of iron wire—if the close-sheathed type is to be adhered to—thereby increasing the difficulties of sufficient and continuous brake application. It is quite a question whether something after the pattern of the apparatus—page 149—employed in laying the first Atlantic cable had not many advantages over the ordinary strap and lever brake, which originated in a hand form with Mr. F. C. Webb's design, provided that some means of keeping the strain within bounds—such as that of Appold, adapted by Amos to the necessities of cable work—be capable of application. It would have been well had Mr. Wilkinson presented an illustration of a more modern form of paying-out dynamometer, such as are specially designed for paying out purposes in being infinitely more sensitive than those used in picking up. There are several of these to be seen—to wit, that on board the Silvertown, due to Mr. E. Stallibrass, and another designed by Professor Andrew Jamieson, F.R.S.E. The book under consideration appears to give no account of the excellent method employed by Messrs. Siemens Brothers for arriving at a correct measure of the slack paid out during the laying of a cable, by means of a dummy line of sounding wire. This is probably the only right plan for this purpose; but requires close study by those proposing to turn it to account with any good effect.

We have to make our way back to Chapter II. for other information relative to cable gear on telegraph ships. Here we find excellent illustrations of the machinery on the John Pender—a good specimen of modern apparatus for picking up and paying out from the ship's bows. In one of the appendices, a description and general view of the gear on the new Japanese Government telegraph ship—Okinwa Maru—are given, but these—evidently from photographs—are of no use whatever in a text-book from a student's point of view. This machinery, due to Messrs. Johnson and Phillips, is said to combine many novel features, one of which is the brake being connected more directly to the cable drum.

Mr. Wilkinson would have been better advised in making more of the Dacia's picking-up, rather than of her paying-out gear. This ship has done much good work in repairs, owing to the sureness and steadiness with which her picking-up apparatus works, due probably to the long crank indulged in on the engine. The whole plant takes up a lot of space, and gives an idea of unnecessary power to some people, but it is just this reserve force which has proved so invaluable when working in deep water with rough bottoms. This gear—designed, like the paying-out gear, by Sir C. Bright many years ago—is, of course, incomplete in many respects as regards convenience, but in its salient points it is probably inferior to none. Constructed as it was by Messrs Easton, Amos, and Anderson, it is of the best possible workmanship.

We are of opinion that Mr. Wilkinson has rather overdone the number of cable ships which he has described and illustrated; and yet we find no view of the Scotia, which, on behalf of the Telegraph Construction Company, has certainly laid a greater total length of cable than any other, though, with a gross tonnage of 4667, she comes third to the Silvertown—4935 tons—and Faraday—4917 tons—in order of actual size. However, nothing but the warmest possible praise can be bestowed on the character of these outline drawings of some of the principal vessels concerned in cable work. In a future edition Mr. Wilkinson might find it possible to condense all the useful information he can collect regarding the various telegraph ships into the form of a table of an extended form similar to that which appears in the "Electrical Trades Directory," and in Munro and Jamieson's pocket-book.

In Chapter I. the author goes into the question of the capacity of a cable tank. The formula given to find the cubic contents of a mile of cable is, we believe—like that in Clark and Sabine—seldom, if ever, used in actual practice. A much simpler one is:—

$$d^2 \times 33{\cdot}2 = \text{bulk of cable in cubic feet,}$$

where d = diameter of cable in inches.

This was given in the last edition of "Munro and Jamieson." When coiling a heavy type of cable, 40 to 45 per cent. is nearer the amount to allow for waste space.

With further reference to the three largest telegraph ships, it may be of some interest to note that the Scotia was formerly a "Cunarder." The Silvertown—originally the Hooper—was designed, or rather, three tanks of given dimensions were built round, for carrying 5000 nautical miles of hempen cable to carry out the Great Western scheme. This scheme never saw daylight, and now when loaded to her "Plimsol" the tanks of this vessel are only about half full with the types at present in vogue. Her cable machinery was constructed to the drawings of the late Professor Fleeming Jenkin, F.R.S. The Faraday was designed especially for this class of work by the late Sir William Siemens, and was the result of a great deal of thought and attention. Her peculiarity is having bows at each end to render her capable of being more readily turned about for sounding and cable operations. Like the Scotia, she is furnished with twin screws, the same object being in view. The most complete description and illustration of H.M.T.S. Monarch, appeared in The Engineer at the time she was launched. Mr. W. R. Culley was mainly responsible for her cable gear, which was constructed by Messrs. Johnson and Phillips. She was the first ship, we believe, to have bow baulks built in with the rest of the vessel, after the plan of Mr. Percy Isaacs, as adopted for all the ships of the Eastern and associated companies. Whilst dealing with the laying of cables, and in somewhat expanding his remarks, Mr. Wilkinson might have touched on the wickedness of attempting to run the ship at a high speed whilst paying out. This is, as a rule, limited by fear of accidents, but when quite large tanks are in question, high speeds are sometimes indulged in. This may be very well from a contractor's standpoint, and has been done with a view to lessening the brake power requirements; but it means that the cable is not laid at an angle which provides for it conforming to the undulation of the bottom. We venture to think that very often insufficient attention is given to the laying of cables in shallow water. In our opinion they are frequently laid too tight, owing to the total weight of cable outboard being comparatively little. We think that to avoid this—besides the ship going slow—the cable should be paid out without any drum whatever, employing only a friction table, as already referred to, for use in case of emergency.

Mr. Wilkinson is rather elaborate on the slipping of final splices, but the sketch on page 122 is probably the only satisfactory method of letting go a bight; the rope, however, would of course be quite taut.

Under repairing operations, which Mr. Wilkinson oddly starts off with, very clear drawings are given of various grapnels, ancient and modern; but mostly modern, we are glad to say. The figures on pages 33 and 34 give an excellent idea of grappling work. The latter is lifelike, inasmuch as it is evidently from a photograph, and under easy circumstances as regards weather, both for grappling as well as for photography. We would not recommend anyone to attempt dragging for an old cable in deep water, with the ship going over the ground at a speed of three knots, as mentioned in a general way by Mr. Wilkinson; though, of course, under other conditions it might turn out all right, or at any rate unattended by further disaster.

In the somewhat full reference to underrunning—beautifully illustrated on page 55—it might have been well to mention that, though this plan in a light boat has been found serviceable by Mr. F. C. Webb, its originator, and by other experienced hands, it is certainly a hazardous process when performed by anything like a heavy steamer. In the pages of this book Mr. Wilkinson has concisely described and illustrated, as far as his space would permit, the main features with regard to buoys and buoying. He might, however, with advantage have given more information with reference to the various descriptions of ropes, connecting chains, &c., as employed in cable work generally.

On the subject of beach cables and underground lines, the author introduces useful excerpts from a report of Mr. Charles Bright, F.R.S.E. He also alludes to Mr. Bright's terminal system, a better idea of which, however, could have been obtained from a sketch. The Eastern Company's excellent system of running their beach cables and connecting lines—between hut and office—into pipes filled with water receives full description. This was first devised by Messrs. Clark, Forde, and Taylor, the eminent consulting engineers. In the event of the above method being inconvenient or impossible, a trench should be dug on the beach of such a depth, and in such a manner, which would assure the constant supply of water round the cable right up to where it runs into the hut.

Unfortunately, it is very much the custom unduly to hurry over this part of the work. The ship being always anxious to get away and lay the cable, leaves hurried instructions which are sometimes only partially understood or attended to, the eventual result often being a fault on the beach or in the hut, after, perhaps, a skilled electrician has been sent out many miles for the express purpose of localising it. Such a fault, it is true, is a less expensive matter than one in deep water; but by allowing a little more time for the efficient installation of the beach cable, any trouble of this sort would be avoided. These seemingly small matters should not, we think, be lost sight of in connection with undertakings of this nature.

Having now dealt with the main substance of the book, in so far as it concerns the engineer, we cannot refrain, finally, from congratulating Mr. Wilkinson on the manner in which he has dealt with the subject, especially in view of the varied methods of procedure resorted to by different engineers.

SUGGESTED TERMS OF AN ALLIANCE BETWEEN THE SOUTH WALES AND MONMOUTHSHIRE COALOWNERS AND COLLIERY WORKERS.

The following is the text of the workmen's scheme for preventing the underselling of coal in Wales:—

(1) The object of the alliance shall be to secure such prices for coal as will guarantee a reasonable profit to the owner and fair wages to the workmen.

(2) It shall be a recognised principle of the alliance that both profits and wages shall always be so regulated as to insure only fair and reasonable prices for coal, so that the South Wales trade may not be endangered by such excessive charges as to directly invite outside British or foreign competition.

(3) The workmen shall be paid a minimum wage upon the standard rates of 1879.

(4) To secure the object of the alliance, there shall be an undertaking by both parties to support each other in any reasonable and proper manner for the purpose of enabling them to resist mutually the attempts of any who may try to make the South Wales and Monmouthshire mining industry inadequately remunerative to one or both parties—either by selling coal below the price agreed upon, or by directly or indirectly reducing wages below the standard rates recognised by the owners and the workmen at the other collieries working the same seams.

(5) It being well known that prices are now materially reduced by speculative middlemen, who contract to sell coal before they have purchased it, no employer shall make contracts with such middlemen, unless they have obtained a quotation prior to the scale.

(6) This undertaking shall include a pledge on the part of the owners not to employ any but skilled workmen, and on the part of the workmen not to work for any but associated coalowners, or those who—although not members of the association for the time being—are prepared to sell coal at the prices agreed upon by the federated coalowners.

(7) Should it be necessary at any time for the maintenance of the principles of the alliance to call out the workmen employed by any colliery owner or owners, such workmen shall be jointly supported—by the owners making every effort to give employment elsewhere, and by the workmen giving financial support.

(8) It shall be distinctly understood that the alliance shall in no way interfere with the right of the employer to maintain entire control over the internal management of his own colliery; neither shall the alliance prevent in any way the employer from introducing any improved method of production, providing such method does not carry with it a reduction in the wages of the workmen or increased danger to life and limb.

(9) For the purpose of fixing the selling price of coal at a point that will permit the agreed upon minimum wage, a computation shall be made of the average cost of production for the whole of the coalfield for the last three years, either by taking the cost of production for each colliery or a selected number of collieries working the different seams, whichever may be mutually agreed upon, and the average cost, taken with the minimum wage, shall establish a minimum selling price for the different kinds or seams of coal.

(10) The selling price of coal above this point to be fixed by the associated owners from time to time; and, for the purpose of maintaining the agreed-upon fixed price of coal above the minimum, the workmen agree to co-operate with the owners to prevent underselling upon the terms incorporated in the foregoing clauses.

(11) That the working of the double shifts in mines, except in case of emergency, be considered a violation of the principle of this scheme.

(12) This alliance shall form part of the present sliding scale agreement of any future sliding scale agreement or other system of agreement that may be decided upon by South Wales and Monmouthshire coalowners and workmen, or their respective representatives, as a method for regulating wages and other matters pertaining to the mining industry.

TUDSBERY'S PATENT DIFFERENTIAL RECORDER FOR GAUGING WATER.

The employment of submerged orifices for the measurement of water issuing from still ponds involves in practice the simplest of the hydraulic principles applicable to that branch of hydrometry. Nevertheless these orifices are still sufficiently uncommon to merit special consideration by engineers in charge of water supplies—whether for municipal, industrial, or irrigation purposes. The submerged orifice is usually rectangular, and is formed in a thin metal plate set vertically in the wall of the still pond, out of which the water to be measured issues. It is situated at such a depth as to be under all conditions entirely below the surface of the water, not only of that in the pond referred to, but also of that in the basin or receptable into which the measured flow is discharged on the opposite—downstream—side of the plate. Under these conditions the water discharged through the orifice is accurately measured by the dimensions of the latter and the head or difference of level between the water surfaces of the still pond and the basin; and, as in every case where water issues through such openings, a coefficient of discharge, determined by experiment, forms a third factor of the formula.

This expression is—

$$Q = C\,A\,\sqrt{H},$$

where Q denotes the quantity of water passing through the orifice per second, or other unit of time; A denotes the sectional area of the orifice; H denotes the head, or difference between the water levels in the pond and the basin; and C is the coefficient of discharge, determined by experiment.

This important coefficient C appears in all formulæ for the measurement of water by weir or notch or orifice; and in every case it is subject to influences which render its variations exceedingly troublesome, if not indeterminate. It is initially dependent upon the form of the *vena contracta* of the issuing stream; which, with a sharp-edged plate of given thickness, is governed by the form and length of the wetted perimeter of the notch or orifice.

It is therefore readily seen that a weir or notch of the ordinary kind presents in its length, and in the ratio of its length to the depth of the stream of water flowing over it, variable elements that assume a most important character when the quantity delivered by it varies from time to time. Consequently, measurements of discharge by overfall weir can only be relied upon when it takes place under the conditions of previous careful trials made with that or with a similar apparatus. The application of the ordinary weir formulæ given in text-books to the generally dissimilar cases which occur in actual practice, is fraught with a risk, and frequently with a certainty of inaccuracy surprising in amount. It was to minimise this risk of error that the late Dr. James Thomson introduced the V notch, a most valuable invention, unfortunately not generally applicable to large flows. An orifice, whether submerged or not, is entirely free from this source of error, the section of the stream passing through it being constant in form.

A further important difficulty attending expressions for weirs and notches arises from the consideration that the velocity at every point of the stream must—theoretically—be regarded as that due independently to the head at every horizontal plane of the cross section; and the inclination assumed by the surface of the water in passing from a condition of rest in the pond to the crest of a weir gauge affects the cross-section of the discharging stream in an uncertain and variable degree, necessitating further correction by the coefficient of discharge. This coefficient is indeed so variable, even under similar conditions in the form and structure of the gauges, that, to insure accuracy, engineers have frequently, in important works, had recourse to a series of direct experiments upon the gauges employed, being unwilling to rely upon the experience of former investigations elsewhere. The expense and trouble incurred in such experiments render it practically impossible to undertake them generally in the smaller class of waterworks; and there the question of the trustworthiness of gaugings must generally be largely dependent upon the number and importance of the variable elements covered by the coefficient of discharge.

Such complexities are comparatively absent from orifices completely submerged, which, with a constant section, possess the additional advantages of causing only a part of the loss of head involved in the use of weirs or other—free—orifices, and of being uninfluenced by wind or by variation of the water level in the basin receiving the discharge, which may, even without "drowning" a weir gauge, cause entire dislocation of the conditions of its discharge.

As regards accuracy of gaugings in relation to observations, it cannot escape notice that the weir gauge formula involves the cube of that portion of the head which enters into the formula for the orifice gauge; a fact which renders it sufficiently clear that any error in the measurement of head with the latter apparatus is insignificant in relation to a like error in the case of the weir gauge. It may well be enquired why, if the submerged orifice presents such advantages over other forms of gauge, its employment is not universal? There are two principal causes of this:—Firstly, no doubt whilst popular acceptance of hydraulic laws is slight and superficial, a visible flow from a gauge discharging freely in air must appear so convincing in fact as largely to overcome any doubts as to its shortcomings in definite result; whilst, in the second place, the measurement of the head in the case of submerged orifices has hitherto generally been made the subject of two separate observations—an important addition to the work involved with other forms of apparatus, where a single reading suffices to indicate the head.

The former cause of objection may be long in disappearing altogether, although not in the present day recognised by engineers. The latter objection has been of more practical importance, and would so remain were there no simple method available of indicating and registering the head by a single operation. Such a device being, however, now available, removes the serious practical objection to the otherwise desirable method of gauging by submerged orifice. Its essential feature is the combination, by means of a suspended pulley, of the actual motions of two floats to reproduce their relative motion on any desired scale in a single pen or pencil of the kind with which recording gauge apparatus is ordinarily equipped. It will be understood that by the use of two pencils, one fixed to each float, the head would be measurable by the difference in the space separating the two traces, but Dr. Tudsbery, by using one pencil on the right of a line coupling the two floats, gets a differential motion, and the head is measured by the space between the base line on the drain and the pencil trace.

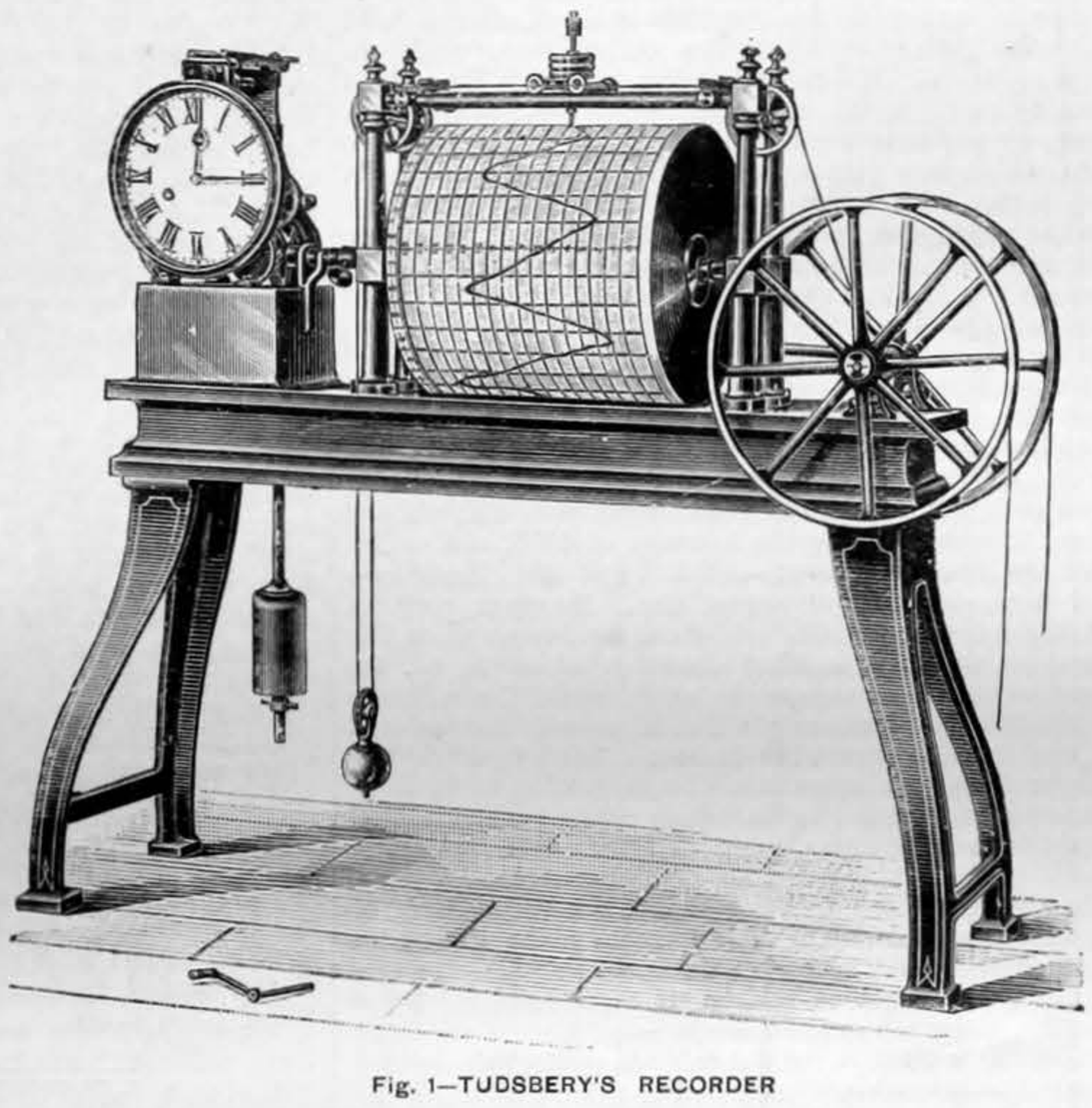


Fig. 1—TUDSBERY'S RECORDER

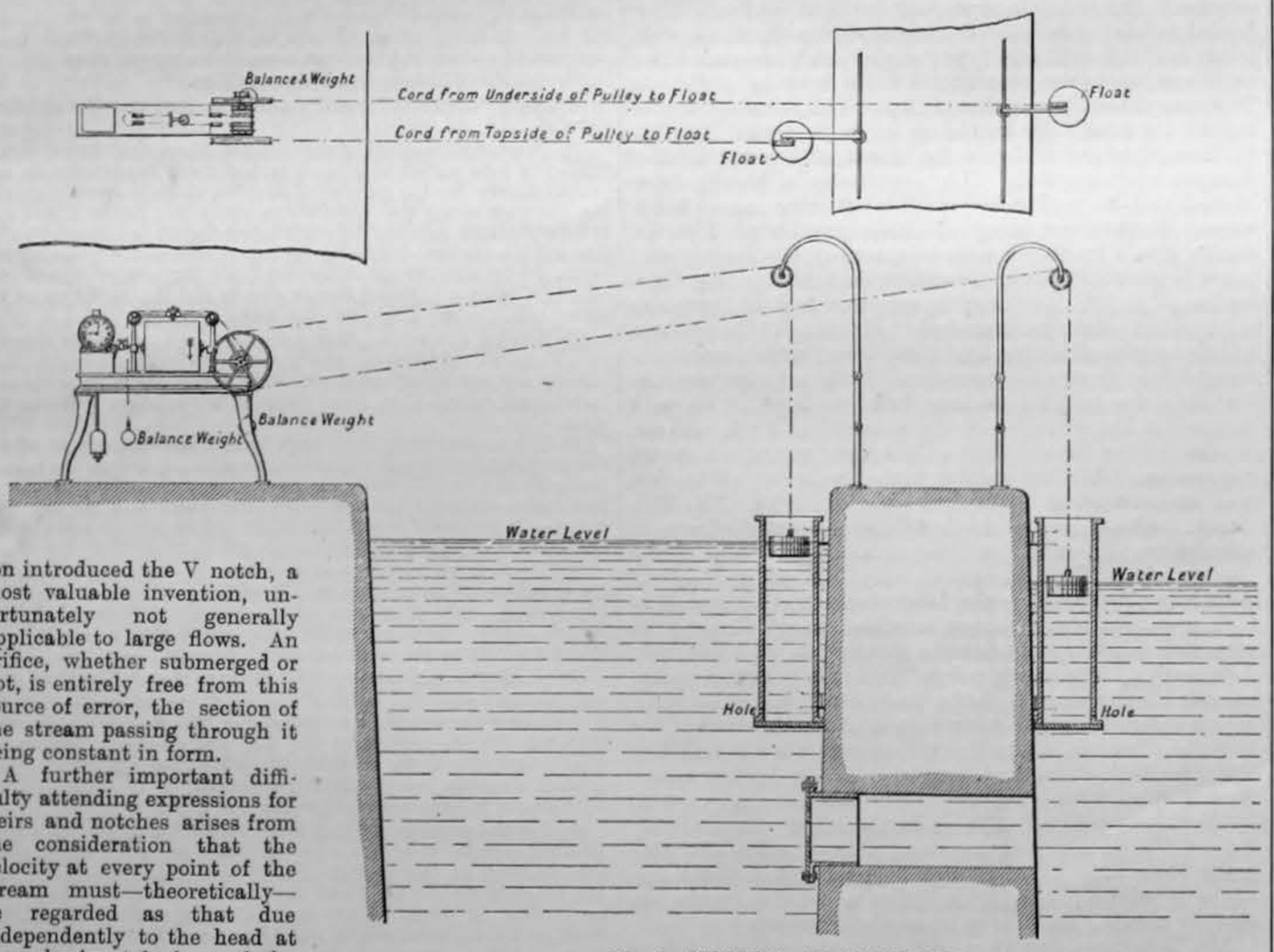


Fig. 2—DIAGRAM OF RECORDER

This contrivance enables the head, or relative water levels, to be measured directly in a single operation, no matter how the absolute water levels on either side of the orifice may vary. It was originally invented for a special purpose by Dr. J. H. T. Tudsbery, and the form in which it has been adapted to ordinary gauging purposes by Sir W. H. Bailey is illustrated in Fig. 1.

The determination of the coefficients of discharge proper to such vertical submerged orifices as are referred to, has been within the last few years made the subject of careful inquiry by several investigators, among whom may be specially mentioned, Mr. T. G. Ellis and Mr. Hamilton Smith. Reference to the work on "Hydraulics" by the latter engineer will convince any person of the importance attaching to the question of gauging by means of orifices, and of the care that has been exercised to obtain trustworthy coefficients of discharge applicable to them. For the coefficients applicable to larger submerged orifices, such as are met with in river, canal, and dock works, the investigations of Mr. R. H. Rhind, published in the "Minutes of Proceedings of the Institution of Civil Engineers," vol. lxxxv., may be consulted with advantage; whilst many valuable isolated data are found in the pages of occasional papers and essays treating of particular hydraulic works.

The recorder may be described as consisting of a cast iron lathe bed on legs. It is fitted with an eight-day pendulum clock beating seconds; the drum is 42in. in circumference, revolving once in seven days, giving ¼in. to the hour on the diagram, the drum being 14in. long, recording a difference in level of 2in. to the foot for a fluctuation of 6ft. Of course, these measurements may be varied according to the delicacy of the diagram required. Arrangements have been made for the sole manufacture with Messrs. W. H. Bailey and Co., of the Albion Works, Salford, Manchester, who have a number of recording instruments in course of manufacture at present, their design having been accepted by the Western Australian Government for tide gauges, and also by the Fisheries Commission of the United Kingdom for recorders for indicating the fluctuation of rivers, &c. One of Tudsbery's patent recorders has not long since been fixed at the mouth of the river Weaver to indicate or record the quantity of water flowing through from the Manchester Ship Canal, according to the Parliamentary conditions.

THE COAL SUPPLY OF LONDON.

On Saturday last the newly-formed syndicate trading as William Cory and Son, Limited, and embracing the following firms: Messrs. Lambert Bros., D. Radford and Co., Beadle Bros., Limited, J. and C. Harrison, Green, Holland and Sons, Mann, George and Co., G. J. Cockerell and Co., Limited, and Wm. Cory and Son, invited a number of gentlemen to pay a visit of inspection to their numerous premises on the Thames, with a view to witnessing the rapid unloading and barging of coal on the river. At Bugsby's Hole some 750 barges, each carrying from 50 to 200 tons of fuel were moored, all either loaded with or waiting for coal from the derricks. These interesting appliances are nothing less than large floating vessels fitted with complete hydraulic and electric lighting plants. One of these derricks which was inspected is divided up into sixty water-tight compartments, and is fitted with ten hydraulic cranes of three different types, viz., the ordinary swinging crane, the overside crane, and the luffing crane. Four colliers can be worked at the two derricks at one and the same time, and some 5000 tons of coal placed in barges in twelve hours, each bucket of coal being weighed at the moment of rest before tipping. Buried in the iron compartment is a complete engineer's repairing shop. Each derrick contains—besides the hydraulic machinery, cranes, and accumulators at either end, weighing 40 tons each—ten boilers, for driving the machinery. Electric current for supplying light, not only on deck but also in the holds of the colliers or lighters, is supplied by one of two steam dynamos.

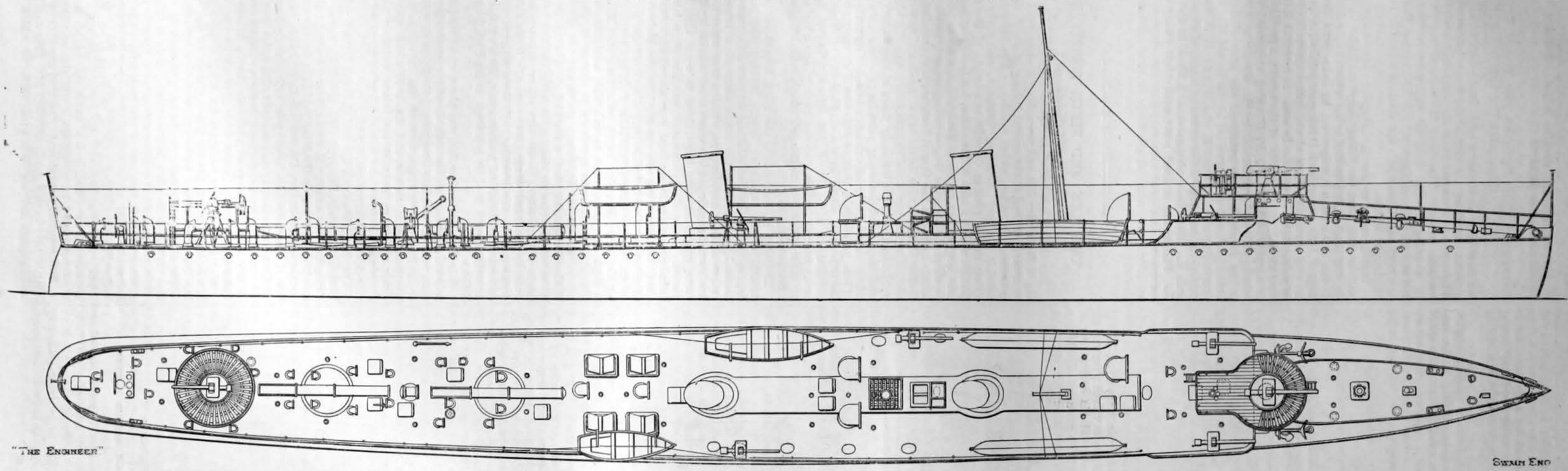
At Charlton the building of barges is conducted at Messrs. Cory's works, and here the party was enabled to inspect one of this firm's seagoing lighters, which have now been running between the Humber and the Thames for two years in all weathers. These lighters have capacities varying between 350 tons and 1000 tons each. They are built of steel, with a water-tight compartment at either end, and are provided with steering gear, so as to be able to take care of themselves should they become adrift. At the Victoria Dock one of the finest steam colliers belonging to the syndicate—the Harpalus—was open to inspection. This vessel is 247ft. long by 35ft. beam, 16ft. depth of hold, and draws, when fully loaded, 16ft. 6in. She has a carrying capacity of 2020 tons, and is driven by a triple-expansion engine of recent design. The storage capacity at these docks alone is about 50,000 tons, and the jetties are fitted with hydraulic cranes for discharging three colliers simultaneously. At the entrance to the Albert Dock Messrs. Lambert's jetty was visited, and at Tilbury Messrs. Harrisons' new cranes, recently built by Sir W. Armstrong, and having a radius of 47ft. 6in., were seen at work. Altogether the associated firms have a fleet of thirty-one steamers, ten sea-going lighters, twenty-five tugs, 1250 barges, and several thousands of railway trucks.

That they have the power largely to influence the coal market of the metropolis must be evident, and it is to be hoped that their combined strength, together with the extra facilities which will be available for handling the material, will be used to reduce the enormous profits which are made between the pit's mouth and the consumer.

The Civil and Mechanical Engineers' Society paid their second visit to the new dock of the Surrey Commercial Dock Company on Wednesday, September 23rd, and afterwards inspected the grain warehouses and pumping plant of the company. The new dock, when complete, will be 2500ft. in length, and have a depth of 27ft. over the sill. Mr. J. Wolf Barry, C.B., M.I.C.E., is the engineer to the new dock, and Mr. J. Gaskell, M.I.C.E., is the engineer to the company. The former was represented by Mr. Wales, who courteously showed those present over the new work, and the latter kindly conducted the party over the grain stores and pumping stations.

THE TORPEDO-BOAT DESTROYER, DESPERATE

MESSRS. THORNYCROFT AND CO., CHISWICK, BUILDERS AND ENGINEERS



"THE ENGINEER" SWAIN ENG

THE TORPEDO BOAT DESTROYER DESPERATE.

A SLIGHT defect having made itself apparent towards the end of the official speed trial of this vessel—built by Messrs. J. I. Thornycroft and Co., Chiswick—made on September 4th, a supplementary trial of three hours' duration was undergone by her on Thursday, the 24th inst., the conditions being the same as those observed on the first occasion, viz., that the boat should have on board a deadweight of 35 tons, exclusive of her ordinary equipment; that six consecutive runs on the measured mile should be made at the Maplin, during which the number of revolutions were to be noted; indicator diagrams taken to ascertain the horse-power developed; and that the consumption of coal during the trial should be determined.

The results of the speed trial on September 4th were as follows:—

Miles run.	Time. min. secs.	Speed in knots.	Revolutions. Starboard.	Port.
1	1 55	31·30	393·0	408·1
2	2 16	29·6	403·7	416·5
3	1 54	31·52	401·4	388·3
4	2 28	29·31	400·2	409·5
5	1 55	31·3	402 4	410·2
6	2 22	29·46	400·2	406·2

Mean speed on measured mile .. .. 30·428 knots.
" " " three hours' run.. .. .. 30·018 "

It will be seen from these particulars that the conditions laid down by the Admiralty as regards speed, &c., were most satisfactorily fulfilled, and the coal consumed—2·43 lb. per indicated horse power—was actually less per horse-power per hour than was the case at the fuel-consumption trial made in April last, and reported in our columns at the time.

The result of Thursday's trial proved that the slight defect had been made good to the entire satisfaction of the engineer officers responsible for the final acceptance of the boat, and Messrs. Thornycroft and Co. are to be congratulated on being the first of the contractors competing for the construction of this class of vessel to attain the high speed reached under the onerous conditions imposed upon them.

The Admiralty were represented by Fleet-engineer W. J. Harding, and the contractors by Mr. C. W. Keighley, the machinery being, as usual, in charge of Mr. George Brown.

The Desperate, it will be remembered, is the first of the batch of 30-knot "destroyers" ordered last year by the Government, and as she has thus been successfully tried and completed, a large addition to the Navy will shortly be made by the firm in the same class of vessel.

Messrs. Thornycroft have in hand for delivery to the Admiralty in the autumn of next year H.M.S. Albatross, the guaranteed speed of which is to be 32 knots per hour.

COLONIAL SAMPLES EXHIBITS.

WHEN noticing the first display made of the above at the rooms of the London Chamber of Commerce in a late issue, we named the intention to follow it by that of foreign samples from other Colonies. A second series has now been prepared, the contributions sent to this country for the Australian Colony of Victoria having been selected for this. The number of these is somewhat restricted as compared with that supplied by the associated West Indian Colonies; but it, nevertheless, possesses some features of special interest.

Foremost among these must be reckoned the evidence afforded by this collection of the care and forethought shown by foreign competitors in adapting their exports to the special requirements of the locality for which they are destined. There is a marked distinction to be observed in the character of the tools, for instance, supplied for the Victorian market when these are compared with those shipped for sale in the West India Islands. In the latter instance the labour is nearly entirely that of the coloured races. The physique of these would not be competent to the handling of tools of a very solid, and consequently heavy character, and the German and American manufacturers, it was evident from the character of the tools supplied by them, had not lost sight of this fact. The conditions of labour in Victoria differ entirely; there, almost without exception, the handicrafts are pursued by Europeans, these, again, being chiefly of British nationality. We find, therefore, a marked increase, both in weight and of strength in the tools shipped from the two countries above-named, for their use. And corresponding to that increase there is manifest a quality superior to that of the tools for West Indian use, this being doubtless thought to be required to satisfy the more experienced criticism of the European workman. Both these differences have naturally caused the prices quoted to be raised somewhat above those cited in our first notice of these exhibits; but these are still so low as to render it no matter for surprise that the goods meet with ready purchase. As in the case of the first exhibits made, this second edition comprises articles of much variety. It includes, for instance, hardware, textile fabrics, glass and porcelain, brushes, foods, seeds, and many other classes of production. It is to the first of these items, however, that we primarily devoted attention on the occasion of our inspection.

The article that perhaps struck us more strongly than any other was a claw-hammer, which is stated to have a great preference in the Colony over those of British manufacture. And we could realise readily why this should be the case. To obtain with our ordinary hammer of home manufacture the maximum of leverage for the withdrawal of firmly fixed nails, it is nearly always necessary to invert the tool. With that sent from the United States there is no necessity for this shifting of position. In its case the claw is not only of greater length than is usually given to the British pattern, but it is given more prominence and a more pronounced curve of form. The leverage obtainable with such a tool must be sufficient for nearly all purposes without the inversion above spoken of being made. These hammers, which are in all respects strong and well made, and noticeably so in respect of their handles, cost, landed in Victoria, 1s. 9d. each only. And as regards this tool, and, indeed, as regards a very large proportion of the tools exhibited generally, it is to be remarked that so high a finish is given to them that their metal closely resembles nickel in appearance. A workman proud of his tools would certainly have his eye struck by this when selecting his purchases. Another hammer is a steel adze-eye tool, of good quality and special shape, which is said to secure preference. There are two qualities of this, the best being priced at 14s. 8d. per dozen f.o.b. New York, and the second quality at 10s. the dozen. We much admired the screw wrenches of United States make. These were well finished, strong, and handy in grasp, a further important feature being that their screws were so truly cut that there was none of that loose play in the jaws that not unfrequently gives rise to slip and injury to the workmen's hands. These were priced at 26s. 6d. per dozen landed in the Colony. The miners' shovels shown are said to secure great preference over our own similar supplies, and the price quoted for them, 28s. per dozen f.o.b. New York, struck us as being remarkably low. The carpenters' saws shown were of far better quality than those upon which we adversely remarked in the West Indian exhibits; but then their prices were double that previously quoted. But even at that increase they were decidedly of good value. In other directions the United States manufacturers show strong competition, and much notice was attracted to a small lawn-mower suitable for family uses, which is priced as low as 8s., f.o.b. Something of the same low-priced and light kind is a desideratum among many home horticulturists in this country. Again it has to be remarked that in their system of packing for sale the foreign manufacturer is ahead of our own. Every household is a considerable consumer of tacks, and the prudent housewife, when purchasing these, would certainly be attracted by the neat little wooden barrels in which the foreigner supplies them, these being sure to come in handy, when emptied, for many housekeeping purposes.

We shall not venture to enter with any detail upon other departments of this show, in which Germany, France, Belgium, and Holland are chiefly represented. Austria, too, demands some attention for her exhibits of such trifling but useful matters as hooks and eyes, so displayed as to be sure of attracting the eye of the seamstress wives of our colonists. But it is in the matter of glassware, perhaps, that the exhibit shows how severe a competitor our manufacturers must have in Germany. Our colonists are often "thirsty souls," and the replacement of breakages of soda-water tumblers often constitute a heavy item of housekeeping expenditure. These tumblers, we notice, the German makers supply of quite sufficiently good quality for ordinary use at 1s. 3d. the dozen f.o.b. Antwerp, while Belgian cut ale glasses are priced as low as 2s. 2d. per dozen under similar conditions as to shipment. It is needless that we should enter further into particulars. We need only say that we were much gratified to observe that on this second occasion the interest taken by our own manufacturers had not only not diminished, as compared with the first, but that even on the first day of its opening the rooms were well attended by them or by their representatives, these closely scrutinising all articles in which their special interest lay.

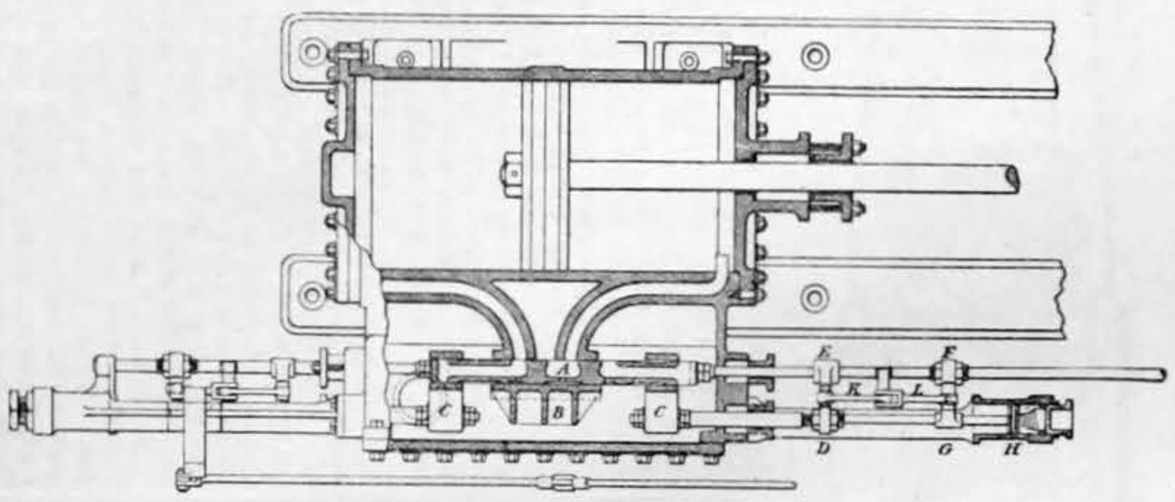
A RESOLUTION was passed at the inaugural meeting of the newly-formed Thames Navigation Association:—"That this meeting, being convinced that the traffic on the Thames is greatly impeded by the present condition of the river, considers it desirable that a three-quarter tidal lock be constructed at a point between Putney Bridge and Wandsworth Mill."

THE FEDERATED INSTITUTION OF MINING ENGINEERS.

In continuation of the report which we commenced last week of the Cardiff meeting of this Institution, we now pass to Mr. W. D. Wight's paper on

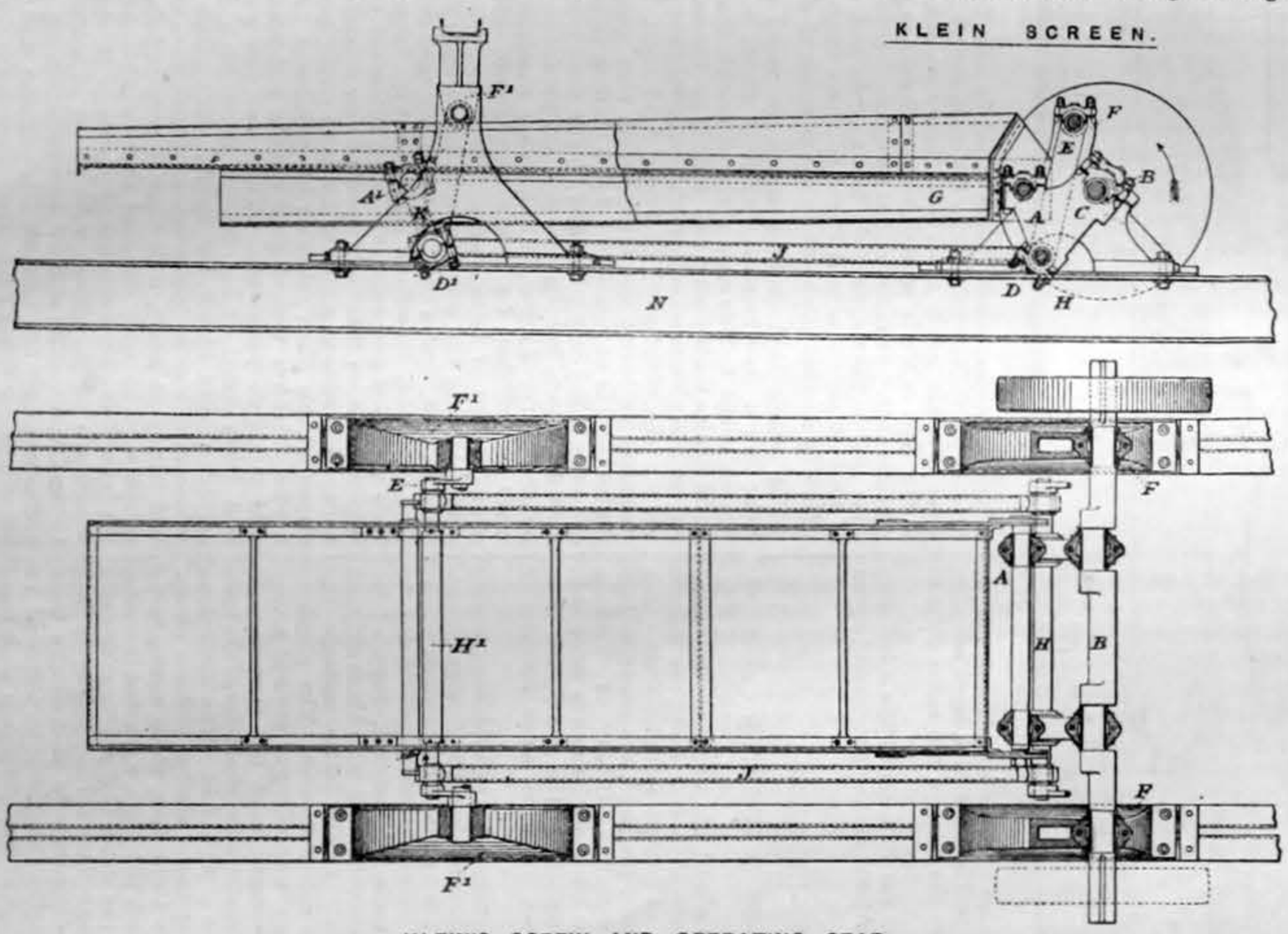
Automatic Variable Expansion Gear applied to Balanced Slide Valve Winding Engines.

The arrangement suggested is illustrated below, and is thus described by the author. The main valve A is of the slide valve type, with a balance plate B on the back to relieve the pressure of steam. It is preferably made wedge-shaped in section, so that the steam may be applied to the top and the bottom of the valve, except for the two strips of metal upon which it slides. The wide end of the wedge is placed downwards. The area exposed to steam underneath the valve is greater than the area of the top of valve, so as to perfectly balance it. The valve is extended beyond the face of the ports, and steam passages are carried through it, to allow the cut-off valves C C to encircle the main valve. The expansion valves, of which there are two, C C, upon each main valve, are simply hoops around the main valve and sliding upon it, having the power to close the steam passages through the main valve. The motion of the valves by means of the gear may be described as follows:—The main valve is actuated by a spindle E F attached to an ordinary link motion; but for the purposes of the expansion valves, the spindle is carried through the back end of the valve chest. Each cut-off valve has a separate spindle D G, and these are connected to the main valve spindles through toggle-joints K L, or a short connecting rod hinged in the middle—one end F of the toggle being rigidly connected to the main valve spindle, and the other D to the cut-off valve spindle.



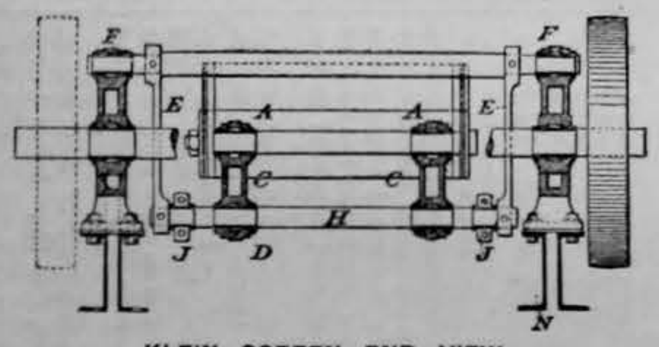
BALANCED SLIDE VALVE

It will be seen that, so long as the toggle is straight, the main and expansion valves will move to and fro together, with the steam port in the main valve open; but when the joint is bent, the pressure of steam in the valve chest, acting upon the area represented by the



KLEIN SCREEN.

KLEIN'S SCREW AND OPERATING GEAR



KLEIN SCREEN—END VIEW

section of the expansion valve spindle, will drive outwards the cut-off valve, and thereby close the steam passage at that end of the main valve. The straightening of the joint to allow of admission of steam upon the next stroke is accomplished by the main valve spindle carrying its end of the toggle back until the two rods forming the joint are in line. In order that this may be satisfactorily accomplished, it is necessary to prevent the cut-off valve spindle being driven too far back, or the joint would not straighten, and this is provided for by a volute spring within a dash-pot H, which cushions the backs of the expansion valve when closed by the steam, and holds its spindle until the main valve spindle returns far enough to straighten the toggle joint. A small air valve is attached to the dash-pot to give free access to the air to fill the dash-pot. The tripping of the expansion valve is accomplished by a projection forming part of one of the toggle joint levers coming into contact with a stop, the position of which is regulated by a governor set to the required speed. It will be understood that during steam admission the joint is always straight, and during expansion it is always bent.

An indicator diagram, taken from a winding engine, shows that the expansion is varied according to the load and speed, and that even in a winding engine the speed can be controlled with certainty. Among other advantages it is claimed that the valves, having all plane faces, are capable of adjustment; the valves, being balanced, the wear is infinitesimal; there are no additional excentrics required for the expansion valves; the cut-off is independent of the engineman, but his control is not complicated or interfered with; the governor adjusts the steam to the work it has to do, maintaining the engine at a constant velocity as soon as the desired speed has been attained, by cutting off the steam earlier at each succeeding stroke as the load lessens; and lastly, one of the most prolific sources of loss of power in quick-running winding engines is overcome, as the back-pressure is inconsiderable, even when the engine is

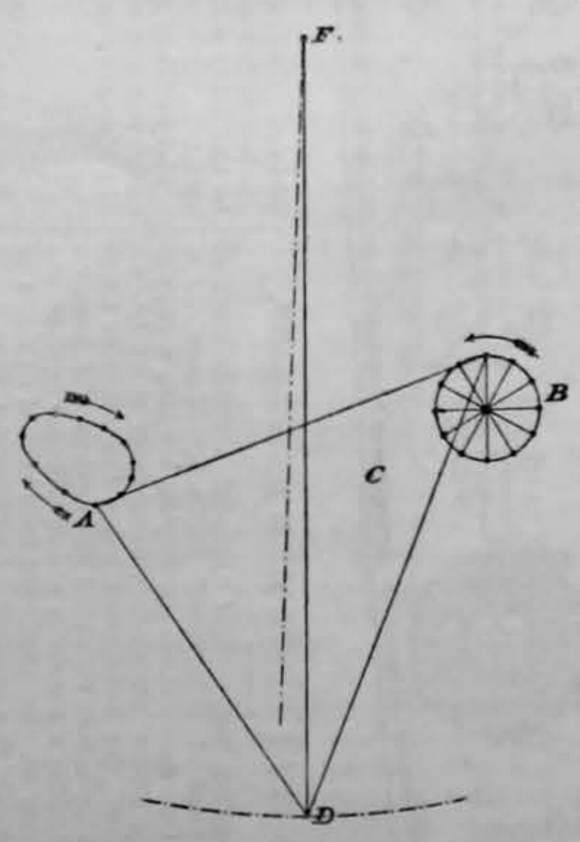


DIAGRAM OF ACTION OF KLEIN'S SCREEN

making a wind of 25¼ revolutions in 27 seconds, including the acceleration and retardation accompanying the starting and stopping of the engine. Although the application of the valve gear described in the paper is to a winding engine, the arrangement is equally suitable for other engines.

The meeting did not take quite such a favourable view of the arrangement as Mr. Wight. Turning to that gentleman's other paper on

Anthracite Coal Breaking and Sizing Plant at Glyncastle Colliery,

we now give illustrations and description of the Klein screens, reserving the tippler for some future occasion. The tippler is constructed so that it travels at the variable rates. The first 11 seconds are occupied in inverting the full tub, the coal then commences to fall and continues falling until the 26th second, then there is a very rapid recovery, the final two periods bringing the tippler to rest.

Turning now to the Klein screen (see engraving) it will be seen that the triangular crank-piece C, on the driving shaft B, is attached to the screen frame at A. At D this crank-piece is suspended by links from the bearings F. As a result of D being suspended, A describes an oval curve, the shape of which depends on the position of points A, B, D, and F. In order to transmit this same oval motion to all points of the screen, a parallelogram is adopted:—A, D, D', A', D' being suspended from a bearing F', and connected to the screen at A'. The points D are hung by means of the links E from the bearings F, and are connected by the tie-rod H. I, I are connecting-rods between H and H', and H' H' are connected to the frame of the screen by means of suspension-rods K. The whole arrangement is fixed to the frame K. The screen is fixed horizontally, but owing to the compound link gear motion, which the diagram below explains, the coal is gradually worked toward the delivery end.

THE IRON AND STEEL INSTITUTE.

(By our Special Commissioner.)

The Ormuz left her anchorage at Bilbao on the morning of September 5th, and proceeding at easy speed to the westward, arrived at the second halting place of the programme, Santander, about midday. The intermediate coast is of a very forbidding character, with rocky slopes rising in the peak of Cerredo to a height of more than 2000ft. within a mile of the shore, but broken at intervals into deep creeks, or where the headlands are so placed as to afford shelter from the prevailing westerly swell, giving secure harbours, like that of Santona, or the smaller one of Castro Urdiales, with its old-world castle and fortress-like church perched on a rocky promontory, covering a narrow anchorage, which in the early years of the century was a well frequented sheltering place for privateers, and after a long interval of quiet existence as a fishing port, has of of late years again become active as a shipping place for the iron ores, raised in the district, out of direct communication with the Bilbao River. Special loading arrangements for this purpose having been adopted, and at other places—a notice of which will be given on a future occasion.

The city of Santander, the most important trading centre in the north of Spain, forming the port of departure for the Transatlantic steamer line, extends for about 1½ miles along the north shore of a broad, but rather shallow bay, through which a deep-water channel has been dredged, and the water front is faced by lines of stone quays, allowing large ships to come alongside in places. Some disappointment was therefore felt, and found expression in the local journals, when it was found that the Ormuz was not coming into the harbour; but this step, however desirable it might have been, could not be taken, because the only available moorings were occupied by the guardship, the heavy cruiser Alfonso XII., and a large troopship, about to sail with reinforcements for Cuba, so that it was necessary to remain in the roadstead, outside the lighthouse point, and use the tender Bilbao for landing and embarking. Wednesday afternoon was devoted to visiting the town and the watering-place of Sardinero, in the bay, where a reception was held by the local committee; and the festivities were continued in the evening by illuminations, open-air concerts, and theatrical performances, the townsfolk being as enthusiastic in their greetings as their neighbours at Bilbao.

Saturday, September 6th, was given up to visiting the mineral deposits near the town, for which purpose the members were divided into five groups, the three largest going to the iron ore workings, a fourth smaller one to the zinc ore workings of Reocin, and the last, which was exclusively a pleasure party, to the inland watering place of Fuente del Francis, the whole being so managed as to return to the ship about 6 p.m.

The iron ore workings are situated in two principal localities, namely, Camarge Hill, about 6½ miles, south-west, and the Carbarga Mountain, about the same distance south of the town. In the latter, which is the more largely developed of the two, the ores are found in the flank of a line of limestone hills, about four miles in length east and west, as concretionary masses and nodules interspersed in clays, the largest development being at the western end of the ridge in the ground occupied by the Obregon and Cabarceno mines. In the first of these groups, owned jointly by the Vizcaya-Santander Mining Company and Mr. J. MacLennan, the ore-bearing clays extend through the low ground, and to a considerable height on either slope of the hill, the deposits being of irregular shape, and varying from a few feet to several yards in thickness, while in some of the hollows between the spurs of the hill as much as 185ft. has been proved by boring. The floor is formed by a bed of dolomite, very irregularly worn into hollows and projecting points, below which the compact lower cretaceous limestone is found. The workings at present are confined to the north side of the hill, the ore-bearing clay being dug along straight faces from 19ft. to 26ft. vertically apart, and connected together by zigzag lines of railway on a gradient of 1 in 30. The stuff loaded into wagons carrying 2·6 tons each, of which thirty-

three form a train, is drawn by a locomotive on a falling incline of 1 in 50 for 2¾ miles to the washing place at Solia, in the marshy ground on one of the streams flowing into Santander Harbour. Here the clay is disaggregated by jets of water under pressure from 3in. hose pipes, and passed through a riddle which keeps back the larger lumps, the fine stuff and clay going through to the washers. These are cylinders 21ft. 3in. long. 7ft. 2in. diameter at the end, with a conical delivery end, supported on friction rollers and receiving motion by spur gearing. The mixed ore and earth are separated by a constant flow of water; the former is led forward by an internal screw, which delivers it at one end, while the muddy water flows out at the other, carrying with it a considerable proportion of finely divided mineral, which is collected by sizing boxes and current apparatus, and subsequently rewashed, so that only about 5 per cent. is finally lost. The bulk of the washed ore is like gravel in size.

The six washing machines in use turn out about 306 tons of washed ore in ten hours, the yield of the clay being about 21 per cent., exclusive of 40 tons of fine stuff which at present escapes. The tailwater is carried by launders to a settling ground in the marsh, where the suspended matters are deposited, and the clean water flows back to the river. The washed ore is conveyed by an extension of the railway of about three miles to the shipping pier at Astillero, at the head of the bay, where there is a depth of 15ft. at low spring tides, and 2000 tons can be loaded in the day.

The San Salvador Iron Ore Company's mines lie to the east of those of Obregon, the conditions of occurrence of the ore being generally similar, but the workings are on the southern slope, which necessitates hauling the stuff to the washing place, across the hill. This is done by an endless chain railway of 18in. gauge, two miles and 66 yards long, divided by angle stations into six sections, the load on the south side being assisted by engine power through a rise of 345ft. to the summit, and travelling down on the north side 893ft. to the washing place on the low ground. The washing plant is similar to that at Solia but somewhat smaller, and without the separating "grizzly." About 600 tons of earth are washed at the works at San Salvador per day, producing about 120 tons of ore with 57 to 59 per cent. of iron. The average yield of the earth is 6 cwt. per cubic yard.

The Camargo Mines, worked by Messrs. William Baird and Co., yield a Rubio ore with 50 to 54 per cent. of iron by quarrying, as at Bilbao, but about 10 to 15 per cent. of the small stuff is, after preliminary selection and screening, washed in a paddling machine or trough washer, with beater arms, to which the old French name of patouillet is usually given. These ores, unlike those of Bilbao, are products of the alteration of iron pyrites, and not of carbonate of iron; while the pebbles of the ore-bearing clays are probably concretions formed on the spot, and not rolled masses.

The composition is shown by the following analyses of a cargo of Obregon ore shipped in June, 1895, to the Dowlais Company, per s.s. Jane:—

	Dry.	Moist.
Iron	58·80	55·59
Residue	3·90	3·68
Sulphur	0·073	0·069
Phosphorus	0·028	0·026
Lime	0·50	0·47
Manganese	0·33	0·31
Magnesia	trace	trace

The approximate output of washed ores from the river, adjacent to Santander, was in 1895 about 125,000 tons from Cabarga, and 16,000 tons from Camargo, the total export of that year from the port amounting to 203,442 tons.

The party visiting the zinc mines of the Real Asturiano Company was rather a small one, as the distance rendered an early start necessary. The first stage to Torrelavega was travelled on a new narrow gauge railway going to Cabezon de la Sal in the direction of the Asturian coalfield. Here they were met by the general manager, Mr. F. Buhse, and other officers of the company, and drove to the mines at Reocin, about three miles distant. These, like all the other mineral enterprises in the district, are open workings on a bed of dolomite overlying the fossiliferous limestones of cretaceous age, which extends nearly east and west for about two miles, with a breadth of 120 to 150 yards, with a southerly dip. Where least altered in the deeper parts this dolomite carries irregular patches of sulphides, galena, blende, and pyrites which, nearer the surface, have been changed to carbonates of zinc and lead, and brown iron ore. The zinc carbonate, which is the most valuable mineral, occurs to some extent in lumps, of a spongy texture, which only require calcination in kilns, but mostly as a white earthy mass, intimately mixed with clay, brown iron ore, and other matters, rendering a complicated dressing process necessary before it is fit for smelting. The calamine earth follows the surface of the dolomite, which is extremely irregular, and as it varies considerably in composition, as well as in thickness, the workings appear to be of a very unsystematic character, the best guide being the colour of the ground, a whitish tint being taken as indicating the presence of calamine. When this appears a level is driven into the bank and timbered, rails are laid, and a train of wagons is run in to receive the over-burden, which is stripped and thrown down through a hole in the roof of the level, loaded into the wagons below, and drawn to the waste tip, the ore stuff, when cleared, going by other wagons to the dressing floor. The workings are at some height above the valley, so that the ground can be excavated to the full depth of the deposit without pumping. The opening left after the removal of the mineral ground is of a very remarkable character, it being filled with large pillars and tumbled masses of dolomite, in which several shafts and levels, dating back to the period of the Roman occupation, were found in the earlier years of the working.

The dressing floor, which is connected with the mineral workings by a double line of railway of 3ft. 3in. gauge, is of very considerable extent, including crushing, sizing, jugging, and sluice washing plant, driven by a horizontal engine of about 120-horse power by Messrs. Tangye and Co. The bulk of the material, however, being of a soft and incoherent nature, the crushers are principally used in the treatment of the harder rock containing sulphides. the calamine stuff requiring only sizing and jigging, while the finer earth goes in great proportion to the slime washers, which are round bundles, the largest being of Linkenbach's pattern, 33ft. in diameter. The finished slimes, however, carry a considerable quantity of brown iron ore from which they cannot be separated, as the two minerals, limonite and calamine, are nearly of the same density. A proportion of small coal is therefore added to the mixture, which is charged into a reverberatory calciner with two beds, and after drying in the upper one is slowly heated in the lower, the air being so regulated that when the coal is ignited it is burnt by oxygen from the ferric oxide which becomes reduced to the state of magnetic oxide. The capacity of the furnace is about six tons per day. The mixture of zinc oxide and magnetite is then passed in a regulated stream over a number of revolving brass cylinders having a portion of their surfaces magnetised by a series of electro-magnets inside. The magnetic particles in falling are attracted from the stream and drawn round on the surface of the cylinder to a hopper placed below, where the contact being broken, the magnetic oxide falls into a separate hutch, while the zinc oxide passes directly into another receptacle.

A certain quantity of an intermediate product is also obtained, this is lifted by an elevator to a pair of crushing rolls, and the ground stuff passes into a Siemens separator, which is similar in principle to that already described, except that the separation takes place inside a rotating cylinder instead of outside, the separated material being discharged at opposite ends.

The material separated is a fairly good iron ore, as shown by the following analysis:—

Ferric oxide	77·88
Ferrous oxide	3·63
Zinc oxide	7·50
Lead oxide	1·17
Manganese oxide	0·80
Sulphur	0·168
Phosphorus	0·016
Silicon	5·073
Alumina	1·416

But the finely divided condition makes in difficult to use, so that 10,000 tons have accumulated since the electric separation was practically introduced.

The largest pieces of calamine are burnt in kilns very like ordinary lime kilns. The finished mineral is sent by a metre-gauge railway, 5½ miles long, to the pier at the mouth of the Suances River, on the coast, a few miles west of Torrelavega, whence it is shipped to the company's smelting works in France and Belgium. The present annual output is about 15,000 tons, derived from about ten times that quantity of ore stuff and waste excavated. About 600 tons of lead ore are also saved, which go to the company's works at Renteria, near San Sebastian.

The consumption of water in the dressing operations is very large, about 1300 gallons per minute being required to keep the whole plant at work, and this cannot always be obtained in dry years. A very elaborate system of settling ponds and reservoirs has, therefore, been established on the hill side, about half a mile from the works, where the water rapidly clears and is pumped back.

On the return of the members to the Ormuz the events in the official programme were exhausted, and the subsequent proceedings leave little to be noticed. Leaving Santander on Saturday evening, San Sebastian was reached early on Sunday morning, and the day was variously spent, either in the town, which has now become one of the finest watering-places in Europe, or in the numerous picturesque places in the immediate neighbourhood. Prominent among the latter is the old fortified town of Fuenterrabia at the mouth of the Bidassoa, opposite to Hendaye on the French side, which has long been famous for its old and war-worn look, with its stately houses deserted and abandoned. This, however, has decidedly changed; for though the old picturesque place still remains, it has considerably freshened up. The deserted houses are now exceptional, and a smart new watering-place has arisen at its gates, while a very common-place tramway saves the wanderer the walk of three miles across the plain from Irun. The greatest material advance in the district is, however, in the port of Passages, which has been dredged and otherwise improved so that large steamers can enter or leave at nearly all times, and in consequence a very large part of the trade of the north of Spain now passes through it. On Monday, September 7th, a small number of the members took advantage of an invitation kindly offered by Messrs. Griffiths, Tate, and Co., to visit the iron ore deposits at Cerain. Leaving San Sebastian early in the morning by train on the North of Spain Railway, the station at Beasain, about twenty-five miles distant, was reached at 8.30 a.m., and Mutiloa, about three miles from the mines, by about an hour's drive. Thenceforward the progress was mostly a scramble by rough paths and along hill sides covered with broom and heather, until the mines were reached, the deposits consisting, apparently, of large masses of compact brown ore, included between shales below and a limestone above, which in places had formerly been worked for lead ores, these latter seeming to be most abundant in cross fissures, where the brown ore is associated with sulphate of baryta. These original workings have been completely abandoned for a long time, and it is only within a few years that it has been proposed to utilise the iron ores, which have yielded fairly good results upon the trial cargoes selected from the waste lying about. For commercial working it would be necessary to establish a communication by ropeway and light railway with the main line at Beasain, whence the ore could be readily sent for shipment to Passages. This is rather a long lead, and disadvantageous when compared with the mines lying nearer the sea, but it seems likely that these mines may be of considerable value at some future time when those more favourably placed have been exhausted. The situation in the heart of the mountains dividing Guipuzcoa from Navarre is a very striking one, and the interest of the locality, together with the fine weather and the excellent provision for refreshments made by the entertainers, combined to render this one of the pleasantest of the visits made during the trip, although it was certainly the most tiring one. The party returned to San Sebastian in the evening, remaining there for the night, the Ormuz having left for San Jean de Luz, where they rejoined her the next day.

Saint Jean de Luz is an artificial harbour formed by moles extending from the shore on either side, with an isolated breakwater, like that that of Plymouth, in the bay between them; the nature of the entrances and the ground inside, however, not being such as to induce the captain of the Ormuz to go into the harbour. The ship, therefore, remained in the open bay, favoured by continued fine weather, although there were not wanting indications that the stay could not be a very long one. A visit to the Forges de l'Adour, near Bayonne, which had been proposed for Wednesday afternoon, was therefore arranged for the morning of that day, the party leaving the ship early by rail to Bayonne, and thence driving about three miles along the right bank of the Adour to the works at Le Boucau. These works form a branch of the Saint Chamond Company of St. Etienne, or to give the full title, the Compagnie des Haut Fourneaux Forges et Aciéries de la Marine et des Chenius de Fer, which succeeded the old firm of Petin Gaudet and Co. They are essentially steel works, using both the Bessemer and Siemens processes, with the peculiarity that none of the materials used are obtained on the spot, the ores being brought from Spain, and the coal from England, the latter being coked on the spot in Coppée ovens, the coking gases and those from the blast furnaces being nearly sufficient to supply the whole of the steam power in use. The three blast furnaces of 67ft. by 16½ft. of the Buttgenbach form, with the charging platforms and other top fittings carried by iron lattice pillars independent of the slack, make Bilbao and manganiferous ores from mixtures of between 60 and 70 tons each of pig iron, whose composition varies within the following limits:—

Carbon	3·5 ... 3·8
Manganese	2·0 ... 2·5
Silicon	1·5 ... 2·0
Phosphorus	0·065 ... 0·075
Sulphur	0·01 ... 0·05

The steel-making appliances include three 9-ton Bessemer converters and two 15-ton Siemens furnaces, of the original pattern. The range of products is a very wide one, from extremely soft iron of Swedish quality, used by the local smiths and agricultural implement-makers, to rails with 0·7 to 0·8 carbon; the latter being required by the Chemin de Fer du Midi, which is one of the few foreign companies that still adheres to the double-headed chair rail, and with it a steel spring key instead of the ordinary wooden one. The manufacture of these keys was seen by the party. They are made of strips of 0·4 per cent. carbon steel weighing one kilogramme, which are bent by special hydraulic machinery into a flat ring of the same form as the wooden key, each one being tested by a standard length of rail and chair before it is sent away. Tire-making by the Petin Gaudet method was also seen. In this the ingots are cast nearly spherical, in order that any blow-holes may be localised on a point at the top of the mould. These are flattened to cheeses under an 8-ton hammer, opened out by two blows of a conical point on the top of one of 15 tons, which gives a double conical aperture, by which any unsoundness of the surface is driven into the inside, where it subsequently disappears when rolled in the tire mills. The substitute for Swedish iron previously alluded to is a dead, soft material, containing only 0·08 per cent. to 0·10 per cent. of carbon, and proportionately as small amount of manganese and silicon. It is made in the open-hearth furnaces from pure hematite pig upon a basic lining, a small quantity of lime being used in addition to ore for softening. Other specialities of more general interest made at these works are alloys for special steels, such as ferro-chromium and ferro-tungsten. The former is regularly produced with from 65 per cent. to 67 per cent. of chromium, and the latter with 50 per cent. of tungsten, scheelite or calcium tungstate from Greece being used as a source of tungsten. This visit, which was well attended, was in every way a most agreeable one, as although M. de Montgolfier, the managing director of the company, who had intended to be present, was kept away by an unforeseen business necessity, M. Magnin, the director, and M. de Tang, the sub-director, of the works, spared no pains in giving information and explanation upon all points when such information was desired.

On the return of the party from St. Jean de Luz it was found that the weather no longer gave any promise of allowing the ship to stay till the following day, so that when the last of the passengers had embarked preparations for departure were made, and the Ormuz left the bay at 7.30 p.m. on Friday, meeting the promised sea disturbance the next day, which, however, did not prevent her arrival at the Nore in forty-eight hours. The landing was effected at Tilbury by 9.30 a.m. on Saturday, and about an hour later the whole party dispersed, carrying with them the recollections of an extremely successful and pleasant meeting.

The Imperial Tramways Co., which owns the Middlesbrough tramways, is proposing to make such alterations as will admit of their being worked by electricity. At Hartlepool tramway traction by electricity has already been adopted, and is working successfully.

LETTERS TO THE EDITOR.

(*Continued from page* 340.)

A PHYSICAL MATHEMATICAL PUZZLE.

Sir,—Will "Paste Pot" kindly let me know—privately if he prefers it—who told him of the puzzle described in his letter of the 31st ult.? I do not claim to be the inventor of the trick, but oddly enough I have, during the last thirty years, shown it to many persons at home and abroad, and it was novel to them all. After the manner of apprentices I once laced up a driving belt with a half twist in it; and, seeing that both sides were thus brought into contact with the pulley faces, it gradually dawned upon me, I suppose, that such a belt had only one edge and only one surface—a peculiarity not noticed by your correspondent; and no one that I know of has turned this to account, except Beauchamp Tower, who, soon after he heard of the half-twist bands, constructed a 32ft. slide rule within an 8ft. box? I cannot remember who suggested to me, if anyone ever did, the cutting of these bands or rings, nor how, when, or where I first cut them. Perhaps I read of them in some French book as old as the hills. But, returning to "Paste Pot." Had he persevered with the half-twist ring which became "double the size and half the width," he would, on halving the width again, have obtained something more comical than what the whole-twist ring gave him; and it requires plenty of time and a very clear head to solve mentally the ring problem in its more complicated forms. Take several strips of the following widths, 1in., 1½in., and 2in.; make some of each into rings, having a half-twist, a whole twist, a twist and a-half, a double twist, and so on; then imagine the result of cutting the rings so as to make other rings only ½in. wide—that is, a half, a third, or a quarter of the original widths; and try to think what would happen if the rings could be split instead of cut; and finally consider the effect of cutting and splitting combined.

Wm. H. Massey.

Twyford, Berkshire, September 23rd.

FOR THE BENEFIT OF THE ARTISAN.

Sir,—In your issue of the 18th, a letter appeared, entitled "For the Benefit of the Artisan," in which the writer endeavours to show that trade unions, instead of being useful to the working man, are absolutely the very opposite; he is, in fact, standing in his own light by joining one. The first part of his letter is devoted to an inquiry into the financial position of trade societies. Let us see what he says.

If a member gets into arrears with his contribution, he becomes out of benefit. Quite so. But the same can be said of any society, whether trade or a friendly society pure and simple; and insurance companies are even more keen, as your correspondent admits, so in that respect they all stand on a level. As to a member not knowing what contributions he will be called upon to pay, I say he does know, for they are practically constant, or, at any rate, fluctuate but a few pence. An occasion might arise when it is a little difficult to meet the contributions, and it would appear rather hard lines for one to lose the money that had been paid in for years, perhaps; but, I ask, is he lessening his difficulties by failing to do so? He is increasing rather than decreasing them, for his trade or friendly society is very often his only support in times of trouble.

Insurance companies do not offer the same benefits for a smaller subscription, as he will find on referring to a prospectus of any insurance company. The benefits offered by a good trade society will compare favourably with any friendly society or insurance company in this country, and the subscriptions as well. Then in regard to superannuation, the trades unions have the advantage, for supposing a man joins at twenty and is superannuated at fifty-five, he has paid in a sum of about £180, and leaving out of consideration that he may have received sick or out-of-work pay in the interim, where is the insurance company that will pay a weekly sum of 9s. per week during the remainder of one's life for the above £180? As to an artisan buying shares in engineering concerns or building houses, it is too ridiculous to entertain.

According to your correspondent, a large amount of money is spent on men who live on the society. It is obvious that an organisation of any kind must be administered, and in consequence a certain amount of expense is incurred. But those whose duty it is to so administer do real work, and must be paid in the same way that any other workman expects to be. There are about 80,000 members in the Amalgamated Engineers, and out of that number only twenty obtain their living by doing the society's work, so there cannot be much to grumble at on that head.

Dealing with the second part of his letter, your correspondent says that the Amalgamated Society was not originally a fighting body. The policy of the society to-day and that of fifty years ago is, of course, different; but that is due partly to the employers themselves, and partly to the fact that political and social thought has undergone a great change during that time. What satisfied men years ago does not satisfy them to-day, and it is this feeling of dissatisfaction amongst the working class of this country that has placed it in the van of civilisation, progress, and reform.

That the original members of the society were picked workmen I do not wish to deny, but I do deny the statement that no regard is taken of the abilities of candidates to-day, because every young man proposed is, or gives promise of becoming, an efficient workman. Artisans of to-day may not be as good all-round men as they were years ago; but they are quite as valuable to an employer from the fact that they have become specialists, as it were, in one particular branch of trade, and as such have greater wage-earning power. There is a higher class of engineering work being turned out of this country than ever there was before, and it is being done, not by the old-fashioned mechanic, but by the more modern one—the one, in fact, that is looked down upon by men who learnt their trade forty years ago.

Whether there are better men out of the society than in is a question I cannot answer; but this I do know, that most of the good jobs in engineering workshops in our town are all held by society men.

Many men have left the society, it is true; but it is only fair to say that large numbers of them have sought re-admission. They, at any rate, have not found contentment, nor do they think their weekly contribution badly invested. Moreover, there are large numbers of elderly men continually joining—men who have never been members of any trade union; these also see the error they have made, and at the last hour, so to speak, endeavour to rectify it. There may be a certain amount of imposition on the society, but it is not confined to trades unions alone, it abounds throughout the whole of society; so far, however, as the Amalgamated Society is concerned, I can truthfully say it is reduced to a minimum.

A modern mechanic demonstrates his gullibility of intellect by remaining outside a trade union, and the artisan with a ring through his nose, is he not the non-unionist? There is nothing to be ashamed of in being a member of a trade union, nor is there any servitude, but they—the unions—are the natural outcome of independence and manly spirit which has always characterised Englishmen. If we look at those branches of labour that are not organised, or at those countries where trade unions are practically unknown, what conditions do we find? Why low wages, long hours, tyrannical treatment by foremen or employers, and other injustices too numerous to mention. Can we not legitimately infer from this that it is due to the absence of organisation? The British workman of to-day is infinitely better off than his prototype of fifty years ago; the wages are higher, the hours shorter, and the conditions under which he labours better, and in every respect his lot is by far a happier one. This, in my humble opinion, is due directly to trade unions, and is it not a sufficient return for a weekly investment of eighteenpence? A "Non-unionist Erector" may not think so, but it is evident to-day that the majority of artisans think so.

As to trade unions taking up a threatening attitude when asking employers for some concession, well, the Amalgamated Society does not do so, and in evidence of this, let "Erector" refer to the recent circular addressed to the employers in the Manchester district for an advance in wages; where is the threatening attitude there? On the contrary, it was courteous to a degree, as admitted by the employers themselves in their reply. I quite agree that a strike is a most unsatisfactory way of settling disputes, but at present it is the only weapon of defence that working men have. Can "A Non-unionist Fitter" suggest anything else, and what are the peaceable means to which he alludes? If he has solved the great labour problem, let him give us the solution, and he will be hailed as one of mankind's greatest benefactors. Employers are to blame for the modern trade unions, and not the men; they resort to them in self defence. Who then can blame them?

Gorton, Manchester, September 22nd. A Unionist.

LARGE COUPLED WHEELS.

Sir,—M. Camille Barbey—page 263—says I have made "a slight mistake" in writing that the new North-Eastern engines are "the first successful ones with so large a diameter of coupled wheels" as 7ft. 7¼in.

If he will pardon my saying so, the "slight mistake" is his own. I perfectly remember the engines on the Chemin de Fer de l'Est with coupled wheels 2300 mm. in diameter, but the dimensions given by M. Barbey himself show that their wheels were 7 mm. smaller than those of the new North-Eastern engines, and, if they were "successful," why have 42 of their number been altered as he admits by "having been reduced afterwards to 2100 mm. = 7ft.?"

September 12th. Charles Rous-Marten.

LAUNCHES AND TRIAL TRIPS.

The Gaika, the second of the three new steamers being built for the Union Steamship Company, by Messrs. Harland and Wolff, of Belfast, for the South African Trade, was launched on the 22nd inst. The Gaika, like the Gascon which was launched last month, is of over 6000 tons gross measurement, and will be propelled by twin screws driven by triple-expansion engines. The third steamer of this class, the Goorkha, will be of similar dimensions.

On the 23rd inst. Messrs. Ropner and Son, of Stockton-on-Tees, launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 300ft.; breadth, 43ft.; moulded depth, 19ft. 8in., which they have built for Messrs. James A. Wood and Co., of West Hartlepool. The steamer is built on the part awning decked rule, with poop and raised quarter-deck, her dead-weight carrying capacity being 3800 tons on 18ft. 8in. The saloon and cabins for captain and officers are fitted in the poop, the engineers' accommodation being amidships. She is built on the web-frame principle, leaving the holds entirely clear for cargo, and carries her water ballast in a cellular bottom and in the after peak. All labour-saving appliances are fitted for the economical working of the steamer, and also for the expeditious loading and unloading of cargoes. She has steam steering gear amidships and screw gear aft, four powerful steam winches, two large donkey boilers, direct steam windlass, stockless anchors, &c. The engines will work up to about 900 effective horse-power, and are by Messrs. Thomas Richardson and Sons, having cylinders 21½in., 35in., 59in. by 39in., steam being supplied by two large steel boilers working at 160 lb. pressure. As the steamer moved away the name of Suningdale was given to her by Mrs. T. N. Alexander, of Harbour View, South Shields.

On Saturday, the 26th inst., the steamer Tadorna, which has been built by Messrs. Wigham, Richardson, and Co. for the Cork Steamship Company, of Cork, went for a very successful trial trip off the Tyne. The vessel is built of steel, being 255ft. in length by 33½ft. beam, rigged as a two-masted schooner. She has very comfortably fitted accommodation for a limited number of passengers, and has complete arrangements for working the cargo, including four steam cranes and two steam winches. The engines and boilers have also been constructed by Messrs. Wigham, Richardson, and Co., and on the trial trip worked without the slightest hitch, giving satisfaction to all concerned and driving the vessel at a speed of about 12½ knots. The trial trip was attended by Mr. F. C. Kelson, of Liverpool, the superintendent engineer of the Company, and Captain Hore, their commodore captain, as well as by Captain Booth, who will take command of the vessel, and Mr. J. Denham Christie, of the builders' firm was also present.

THE NEWPORT HARBOUR COMMISSIONERS' WEEKLY TRADE REPORT.

Fair attendance on 'Change. Shipments of steam coal for the past week were fully up to the average, and with moderate weather a very good demand may be expected. Prices are without change. The demand for house coal continues good, but the weather has interfered with arrivals of shipping. Prices are firmer. Tin-plates in only moderate demand. The iron and steel works are all fully employed. Iron ore advancing in price.

Coal: Best steam, 8s. 3d. to 8s. 6d.; seconds, 7s. 9d. to 8s.; house coal, best, 10s.; dock screenings, 5s. to 5s. 6d.; colliery small, 4s. 6d.; smiths' coal, 6s. 6d.; patent fuel, 10s. 3d. Pig iron: Scotch warrants, 46s. 1½d.; hematite warrants, 47s. 2d. f.o.b. Cumberland; Middlesbrough No. 3, 38s. 2d. prompt; Middlesbrough hematite, 45s. 3d. Iron ore: Rubio, 12s. 9d. Tafna, 12s. Steel: Rails, heavy sections, £4 15s.; light ditto, £5 10s. f.o.b.; Bessemer steel tin-plate bars, £4 12s. 6d.; Siemens tin-plate bars, best, £4 15s.; all delivered in the district, cash. Tin-plates: Bessemer steel, coke, 9s. 9d.; Siemens, coke finish, 10s.; ternes, per double box, 28 by 20 c, 18s. 6d. to 21s. Pitwood: 15s. 3d. London Exchange telegram: Copper, £47 15s.; Straits tin, £56 18s. 9d. Freights have a strong upward tendency.

AMERICAN NOTES.

(*From our own Correspondent.*)

New York, September 23rd.

All developments point to an increase of pig iron stocks in November and December. Reports in the trade papers also point that way. Brokers and buyers do not think matters can go on in this way much longer. Prices are abnormally low and stocks dangerously light. Of course, winter is coming, and this forbids the undertaking of important work and enterprises in a large section of the country. Be it remembered, in sizing up possibilities and probabilities on this side of the water, that we have been living on scraps after our company, in the shape of prosperity, left us. Everything has been virtually at a standstill for three years, except the equipment of industrial capacity. Despite temporary discouragement, enterprise has been busy in putting shop, factory, and mill capacity of all kinds in better shape, and we find ourselves now on the eve of vital changes in our economic methods, with a capacity for cheap and enormous production never before equalled. We have been whetting our scythes while waiting for the grain to get high enough. The temper of the American people is to secure as large a volume of circulating medium as possible, but not to jeopardise its quality in so doing. The sales of steel for the week show a sluggish market in all branches. In Western Pennsylvania, Bessemer buyers offered less than market rates for large lots, and could not buy. In Chicago markets, inquiry is stronger for shop and foundry and agricultural implement supplies. In the Eastern Ohio region, makers are selling small lots, and are avoiding any further accumulation. An active demand during the closing weeks of the year is very probable. Crop reports are favourable. Large movements of cereals are in progress from farms to elevators and other storage localities. Railroad traffic in the wheat and corn States is improving.

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

(*From our own Correspondent.*)

On the 28th ult. a meeting of the sub-committee of the Midland Iron and Steel Wages Board was held at Dudley for the purpose of receiving the accountants' certificate. Sir Benjamin Hingley presided. The certificate was to the effect that the average selling price obtained by the twelve selected firms for bars, sheets, plates, hoops, and strip, in July and August, was £5 15s. 5·07d. per ton. The average selling price for May and June was £5 13s. 8d.; for March and April, £5 15s. 4·84d.; for January and February, £5 16s. 8·02d.; for November and December last year, £5 15s. 3·08d.; and for July and August, 1895, £5 10s. 3d. Thus there is an advance of 1s. 9d. on the previous two months' average, and an advance of 5s. 2d. on the average of the corresponding period of last year. This is considered very gratifying, though it does not alter the rate of wages, which will remain at 7s. 3d. per ton for puddlers, and millmen's wages in proportion, from October 3rd to December 5th next.

Considerable interest was manifested on 'Change this—Thursday—afternoon in the agitation of the iron workers in the West of Scotland for an advance of wages and for the formation of a wages board for Scotland, instead of continuing to have wages regulated by the English sliding scale. Iron and steel masters here, who suffer severe competition from the West of Scotland works, would be only too pleased to see wages advanced over the border, as, of course, the effect would be to increase ironmasters' costs, and so perhaps lessen the present competition. It is the North of England Arbitration Board, not that in the Midlands, by which Scotch wages are at present regulated, and to ironmasters in this district the demand of the men for a separate board seems entirely reasonable.

Making allowance for the suspended animation which generally characterises the market at the close of the quarter, the state of trade is sound and promising.

All the mills and furnaces are making full time at the completion of orders for the quarter.

In finished iron, marked bars are £7 to £7 12s. 6d.; merchant bars, £6 to £6 10s.; and common bars, £5 7s. 6d. to £5 15s. Black sheets are £6 12s. 6d. doubles, and £7 15s. lattens. Tube strip is £5 10s. to £5 12s. 6d.; thin strip, is £6; hoop, £6 5s. to £6 10s.; galvanised sheets are £10 5s. to £10 10s. for 24 gauge, delivered Liverpool; angles are £5 15s.; stamping sheets, £9 10s. to £10; and nail rod, £6 10s. to £6 15s.

Steel is a large output, and sale is brisk at £4 5s. to £4 7s. 6d. for Bessemer blooms and billets; £5 for Siemens best billets; and £4 10s. to £4 12s. 6d. for ordinary billets. Steel bars are £6, sheets £7, and angles and girders £5 12s. 6d.

Pig iron is in good sale. Staffordshire all mine is 55s., part mine 40s. to 42s. 6d., and cinder pig 36s. 6d. Northampton forge is 40s. to 41s., Derbyshire and North Staffordshire 41s. to 42s., and Lincolnshire 45s.

The export business of the general metal trades of Birmingham keeps good. Australia and New Zealand merchants report a marked recovery of trade recently in those colonies, and especially New South Wales and Westralia. There is also rather more doing in Southern Australia, where the fruit and wine trades are rapidly expanding. The shortness of the wool clip in the older colonies is not favourable to commercial prospects there in the near future, but for the moment there is little to complain of, except, perhaps, in regard to galvanised roofing orders.

Galvanised sheets of an inferior kind have been in rather active request of late for various parts of South Africa, but a good many of the orders have fallen to German makers. On better class sheets, as well as roofing and bridge work, English makers continue to hold their own in South Africa, as well as in India and Australia.

Some of the South American markets, and especially Argentina, Chili, and Colombia, are sending in good indents just now for general metal wares.

The prospects of the welded steel tube trade continue wonderfully good. At the annual meeting of the Star Tube Company, Birmingham, to whose declaration of a 400 per cent. dividend I referred last week, the chairman said "that the tube mill had worked night and day from the time the company was formed, and there was every chance of it continuing to do so for a very long time. Though their financial year was still very young, they had already booked considerably more orders than the total turnover of last year, and they were accepted at greatly enhanced prices. They hoped, therefore, that with an increased turnover, advanced prices, and the cheaper means of production which they were continually finding out, the results of the ensuing year would be almost as satisfactory as the past. They knew that many companies had been started in the tube trade. Some of them would never make a good tube, if tube at all. Many had been over-capitalised, and so forth. They did not fear those companies in any shape or form. The three tube companies which were working in friendly consort would be in the front row whatever the competition might be. No matter what the bicycle trade might come to, there was plenty of scope for the welded steel-tube trade, and they were daily finding new uses for it. It was astonishing what large inquiries they got for tubes for engineering, marine, and many other purposes." It was claimed by subsequent speakers that last year's success was without a parallel in the history of the city of Birmingham.

A dividend of 20 per cent. has just been declared by the Jointless Rim Company.

A machine, which should be of great use to carriage builders and other manufacturers, is West's patent power tire-setter, of which a first public demonstration was given this week at 76, Bradford-street, Birmingham. It is intended to give an alternative to the usual shrinking-on process. In the fixing of the tire no heat is required. The tire, instead of being made under size, is made so that it will just remain in position on the wheel. The wheel is then fixed on a steel table, and pressure being simultaneously applied at every point of the periphery, the tire is compressed until it takes a firm hold. The compression of the tire is effected by a number of segmental pieces, which can be changed to get the right curve for varying circumferences. These segments, of which there were eighteen in the machine exhibited, rest upon sliding sections, each of which is moved radially inwards by an hydraulic cylinder, the fixed piston of which rests against the outer weldless steel ring, which takes the strain when the machine is at work. With a 4-horse power engine and a triple-plunger pump, each of the segments can be made to exert a pressure inwards of fifty tons—a total for the circumference of 900 tons.

A resolution was proposed at the last meeting of the Walsall Chamber of Commerce to the effect that a light railway or tramway along the Birmingham-road, from Walsall to Perry Bar, is undesirable. But other speakers favoured the idea, and the resolution was rejected, an amendment being carried that the matter should be postponed for further consideration. One of the speakers said that from his experience in America he was sure that property along the route would be improved in value.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

Manchester.—The possibility of a prolonged stoppage of operations throughout all branches of the engineering trades of this district has been the chief topic of discussion during the last few days. From all sections of the engineering industry, and the principal centres in the immediate neighbourhood, I still receive reports of continued general activity, on orders already secured, with no scarcity of new work coming forward, and many establish-

ments so fully engaged for some time forward, that they are altogether unable to entertain further orders that might be secured, simply because they cannot undertake anything like early delivery. It is needless to point out that a strike in the engineering trades, under such conditions as the above, would be most disastrous, and the men are apparently taking advantage of their position for enforcing their demand by a resort to extreme measures, as they have altogether ignored the employers' suggestion that deputations should be appointed on either side to discuss the whole matter with a view to a friendly settlement.

Business generally on the Iron Market here continues only slow, and although there was a fair average attendance at Tuesday's 'Change meeting, no inquiries of any moment were reported. In pig iron local users are mostly well covered, or just for the present cautious about buying in view of the unsettled outlook in the engineering trades, and transactions for the most part are limited to comparatively small quantities. Makers do not give way, as they are generally well sold, and comparatively independent about further immediate business; but merchants are low sellers, and in the open market prices are being cut up by cheap second-hand parcels, chiefly of Scotch iron, which since the excessively low sales referred to last week, have been offering more freely. Local and district makers, although not booking many new orders just at present, are, on the small sales put through, getting their full rates, which, remain at 46s. 6d., less 2½ for Lancashire; 43s. net cash for Lincolnshire; and 45s. 6d. to 47s. net cash for Derbyshire foundry qualities, delivered Manchester, with forge numbers averaging 44s., less 2½ for Lancashire, and 42s. 8d. net cash for Lincolnshire, delivered Warrington. In outside brands Middlesbrough also continues very firm, makers of good brands still quoting 47s. 1d., whilst merchants are generally asking 46s. 7d. to 46s. 10d. net cash for good foundry brands, delivered by rail Manchester, with 44s. net, the quotation delivered Ship Canal. Scotch iron, however, is obtainable at considerably under makers' quotations; odd parcels of Glengarnock have been offered, delivered Ship Canal, Manchester, at 47s. 10½d., and can be bought delivered Lancashire ports at 45s. 10½d.; whilst 46s. net prompt cash, delivered ports, represents an average figure at which orders could readily be placed, both for Eglington and Glengarnock in the open market.

A fair demand still comes forward generally in the manufactured iron trade, with prices strong. Lancashire bars are hardening to £5 12s. 6d. on inland sales, although £5 10s. is still a minimum at which they can be bought, with shipping prices firm at £5 12s. 6d. f.o.b. Liverpool. North Staffordshire bars still average £5 12s. 6d. to £5 15s.; sheets are steady at £7 5s. to £7 10s.; and on hoops, although only a slack business is reported, there is no change in quoted list rates, which, for delivery Manchester district, remain at £6 2s. 6d. for random to £6 7s. 6d. for special cut lengths, with 2s. 6d. less for shipment.

Nut and bolt makers are kept very well employed, and have, in some cases, advanced their list rates £1 per ton.

In the wire-netting trade, which for the past eight or nine months has been exceedingly busy, instead of the falling off which is usual at this time of the year, increasing activity, if anything, is reported. Even in the home trade, considering the season, there is an unusual demand, and the shipping business is so exceptionally brisk, that many firms are unable to quote for further deliveries this year, large quantities being exported to the colonies, especially Australia. This large demand for netting has necessarily caused a correspondingly heavy consumption of wire, and a rapid upward move in prices.

The position as regards the steel trade is without material change. Good foundry hematites are still quoted 57s. to 57s. 6d., less 2½, but merchants would sell at under these figures in the open market; steel billets remain at £4 6s. 3d. to £4 7s. 6d. net cash, and bars, which show no appreciable improvement, are still obtainable a trifle under £6 per ton. Steel boiler plates are perhaps rather stronger, and moderate sales have been made for delivery in this district at about £6 5s. per ton.

The wages question in the engineering trades of this immediate district has taken a more serious turn than was at first anticipated; it was thought that after the employers had practically thrown out the suggestion that deputations might be appointed on either side amicably to discuss the whole matter, the Joint Committee representing the various trades union organisations would, in all probability, fall in with this view. The action taken by the Committee, however, now practically destroyed any hope of an amicable settlement. The reply of the employers, of which I gave the full text last week, was considered at a meeting of the Workmen's Joint Committee, but ultimately the following resolution was passed:—"That unless the request for a 2s. advance in wages, contained in our circulars of August 25th and September 12th, be conceded on or before Saturday, October 3rd next, the whole of our members be withdrawn on that date." The ballot of the workmen which followed, and which resulted in an exceptionally heavy poll — in fact, as I understand, much larger than the officials had anticipated — confirmed, in the most emphatic manner, the resolution passed by the Joint Committee. The effect of this decision will be that unless some amicable arrangement, which is not at all probable, is in the meantime come to, the workmen throughout the engineering trades of this district, numbering about 8000, will cease work at the close of the present week, and will be followed on Monday by a similar strike of the moulders, to the number of about 1200, whose demand for an advance is of course involved in that of the engineers, as any action the employers may take must necessarily govern the wages in both departments.

The formal notification of the decision come to by the workmen has been forwarded to the local secretary of the Employers' Association, which is acting on behalf of the general engineering trades of the district, and a special meeting of the employers has been convened for to-day—Friday—to consider what further reply shall be forwarded to the men. In the course of interviews I have had with one or two of the leading representatives of the engineering trades, they expressed themselves quite as determined as ever to resist the advance, the demand for which they considered altogether unjustified on the part of the workmen. The action which several of the principle firms may take will, however, largely influence the other employers throughout the district. It is admitted that in the case of one or two large concerns, mainly engaged on specialities, the advance may be conceded. Their possible action has, however, to some extent been discounted, and even in the event of these firms giving way to the demand of the men, the other establishments who signed the general undertaking at the last meeting of the employers will, in all probability, hold out; but any further breaking away on the part of engineering establishment, of importance could scarcely fail in enabling the men to secure the advance in wages which they are demanding. As I have already intimated the advance of 2s. per week demanded by the moulders—whose notices to cease work in the event of its not being conceded practically coincide with the threatened cessation of work on the part of the engineers—will follow the course of events in the engineering trades question, and any decision the employers may come to at their meeting to-day (Friday) will govern the action to be followed both by them and the foundries with regard to the wages of the engineers and also the moulders.

Although there have been at various times isolated disputes affecting individual firms, it is many years since the Manchester district was threatened with so serious a labour conflict as the one now impending. The workmen, in their circular requesting an advance, drew attention to the fact that there had been no movement in wages for more than twenty years, and an official representative of one of the trades union organisations informed me that it is now nearly forty years since there was any general wages strike in the Manchester and district engineering trades. It will therefore be in every way deplorable if this long immunity from any serious friction between employers and employed should be broken through just now, when the engineering industry is emerging from a long period of depression, and reviving activity is promising an encouraging outlook for the future.

The Portable Building and Construction Co. has opened an extensive new works in Manchester, where it will in future manufacture the whole of its specialities in portable buildings, conservatories, stables, coach-houses, bicycle-houses, &c.

There is still no real improvement to report in the coal trade. The better qualities are beginning, perhaps, to move off rather more freely for domestic purposes, but not yet in anything like sufficient quantity to keep pits on full time, and stocks go on accumulating at many collieries, whilst most of them are not working above four days per week. Prices, although tending to rather more steadiness, remain without quotable change. The market for common round coals, suitable for iron making, steam and general manufacturing requirements, is much as reported for some time past, supplies continuing in excess of demand, and prices extremely low, ordinary steam and forge coals not averaging more than 5s. 6d. to 6s. per ton, at the pit mouth. Engine classes of fuel are more plentiful, but any large surplus of supplies is chiefly in the inferior qualities, the better sorts still, in most cases, moving off readily, and fetching from 4s. 3d. to 4s. 9d.; common slack, however, is offered very low, and inferior sorts are obtainable at 2s. 9d. to 3s., with medium qualities 3s. 3d. to 3s. 6d. per ton at the pit mouth.

In the shipping trade, there has been some improvement as regards the weight of business coming forward, but none whatever in prices, which continue very low, 6s. 9d. to 7s. being the full average figures for ordinary steam coal, delivered Mersey ports, or Manchester Ship Canal.

Barrow.—In the hematite pig iron trade business keeps very steady, and prospects continue good and bright. Not only is an active winter assumed, but the forecast for next year indicates a continuance of briskness and activity. Consumers are asking for full deliveries, and speculators and merchants are good buyers. Prices are exceedingly steady, and makers are still quoting 48s. to 49s. 6d. for mixed Bessemer numbers, net f.o.b.; while warrant iron is quoted at 47s. 2½d. net cash sellers, 47s. 2d. buyers. The trade doing is almost wholly in Bessemer qualities, and little is doing in forge and foundry iron. There are thirty-six furnaces in blast, as compared with thirty in the corresponding week of last year. Stocks show a decline on the week of 925 tons, being an increase since the beginning of the year of 12,888 tons. The stocks in hand now represent 302,063 tons.

The iron ore trade is busy only in best qualities, and for these there is a bigger demand than supply, so that the trade doing in Spanish ores remains steady and full, prices for the latter ranging from 12s. to 12s. 6d. net at West Coast ports. Native ores are at 10s. for ordinary qualities, although some sales are noted at slightly lower prices, and 12s. to 14s. 6d. for best descriptions.

A very steady demand is noted for steel of all the descriptions manufactured in this district, but the most notable demand is for heavy steel rails, which are in large inquiry on home, continental, and general foreign account, and prospects point to a continuance of activity in this branch of the steel trade, as the consignments required by users are on a large scale, and important railway extensions are in progress throughout the world. Now-a-days, however, British makers have to compete for the foreign and colonial trades with the Continent and even with America.

Local makers, however, can maintain combination rates at £4 12s. 6d. to £4 15s. per ton, net, f.o.b., for heavy rails, as they are so well sold forward, and see such good prospects of a continuance of good orders. More is being done in steel shipbuilding material, and the requirements of shipbuilders and engineers seem to be on the increase. The heavy plate mills are especially busy, and a good demand is still maintained for heavy steel castings. Hoops and billets are not in as brisk a demand as they were some time ago, but makers are busy and likely to be for some time.

Shipbuilders and marine engineers are in need of new orders, and are busy tendering for some good orders, as well for the Admiralty as for commercial owners. The engineering trade is fairly well employed at present, but new work is required to keep up the present activity.

The coal and coke trades show no change, but it is noticeable that although the consumption of coal is on a comparatively large scale, prices are very low, and competing colliery proprietors complain of the difficulty they have in securing a profit out of the sales they make. The coke trade is steady, and the chief supplies still come from Durham, but the Burnley coke owners are getting a fuller output than of late, and large supplies are coming to the Barrow works from this source. Prices of coke are firm.

Shipping is steadily employed. During last week 5866 tons of pig iron and 8781 tons of steel were shipped from West Coast ports, as compared with 6999 tons of pig iron and 4492 tons of steel in the corresponding week of last year, being a decrease of 1133 tons of pig iron, and an increase of 4289 tons of steel. The shipments this year to date total up to 240,160 tons of pig iron, and 366,150 tons of steel, as compared with 223,699 tons of pig iron and 282,443 tons of steel in the corresponding period of last year, being an increase of 16,461 tons of pig iron and 83,707 tons of steel.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

About an average time is being worked in the South Yorkshire colliery district—from four to five days a week—and the output obtained in that period continues quite sufficient to meet the business. Coalowners still complain that they do not find trade profitable, the pressure being most severely felt, as was to be expected, by the smaller and older coalpits. The difficulty of these concerns in competing with the great collieries possessing the advantages of a rapid, large, and cheap output is increasing every day. Although there are several mining disputes throughout the locality, and no signs of any immediate clearing of them away, less complaints are heard from the men than was the case a month ago. At one or two pits appeals are made to the public for assistance, and these are usually generously met in the immediate neighbourhood of the collieries where the village shopkeepers and others are dependent upon miners for their livelihood. Fewer begging expeditions are now made into the larger towns, as the artisans who suffered so severely from the coal war of 1893 are not quite so ready to spend money to keep the colliers unemployed as they were at that time. In the household sorts the cold, wet weather has caused a slight betterment in demand, but there is less doing with London than the trade anticipated, there being little buying forward, while merchants show reluctance to stock supplies with a view to an augmented winter demand. This causes stocks at pits to continue large, but on Tuesday last the South Yorkshire coalowners held a meeting at the Royal Victoria Hotel, Sheffield, when it was decided that the usual winter advance in the price of coal should take place on the 1st of October, the increase to range from 6d. to 1s. per ton, according to quality. This had the inevitable effect of causing householders to "hurry up" in laying in their supplies for the winter, and the accumulations at the collieries are being considerably affected thereby. Best Silkstones, where the advance has been obtained, will now make from 8s. 6d. to 9s. 6d. per ton; ordinary, from 7s. per ton; Barnsley house, 7s. 6d. to 8s. per ton; other qualities, from 5s. 9d. to 6s. 9d. per ton.

There is a good deal more doing in the steam coal trade, and a very large tonnage is leaving the district, with a perceptible lessening of the stocks which had accumulated two months ago. Hull and Grimsby are taking an average weight for export, and the railway companies are receiving rather over the ordinary tonnage. Barnsley hards make quite 6s. 3d. per ton; secondary sorts from 5s. 9d. to 6s. per ton. In gas coal also there is an excellent business doing at rates varying from 6s. per ton upwards. Although little alteration is shown in the demand for manufacturing fuel, values do not fall. Yorkshire producers are competing keenly in Lancashire and adjoining manufacturing districts. Small nuts make from 4s. 3d. to 4s. 9d. per ton; screened slack from 3s.; pit slack from 2s. 6d.; smudge from 1s. to 1s. 6d. per ton. In coke, North Lincolnshire and Northamptonshire are still maintaining their active call, values ranging from 8s. 6d. to 10s. per ton. Some qualities make as much as 12s. per ton.

Fresh orders are expected from the Government for armour-plates to take the place of those now being rapidly worked out, and are still being waited for, and, so far as can be ascertained, there is no immediate prospect of their being received. In railway material, on the other hand, although no large orders have been placed of late, there is a steady call for nearly all classes of rolling stock. Several of the English railway companies have lately decided to make large expenditure on their systems. This decision was inevitable, as for several years many of the companies have been deferring the more perfect equipment of their lines in stores and plant until the turn of the tide in trade gave increased confidence. That turn has now come, and advantage is now being taken of it thoroughly to equip the leading English lines, as well as those in Scotland with which they are connected.

Some disappointment is expressed with regard to marine work; but there are evidences of improvement in this respect. Freights have gone up considerably, and it is hoped that this change for the better will be permanent, although in one or two quarters the opinion is expressed that the improvement is due to an unusual combination of large cotton and grain shipments, which synchronising at a somewhat earlier period of the season than usual, has brought about a sudden demand for vessels, thus sending freights up. The fear is, that when the present demand is satisfied freights will again relapse; but the principal local houses are hopeful that the improvement will be more lasting.

An important step has just been taken by the Government in regard to files. In tenders previously sent out by the State, it was stipulated that "the whole of the files and rasps should be made of the best refined cast steel, hand cut and sand blasted." It is now evident that these conditions have been modified. The local firms are at present tendering for one Government department, which has ceased to demand hand-cut files. This is the first time that the stipulation has been removed, and it has excited no little interest in the trade. Since the men received a concession of 10 per cent. in wages, the hand-cutting firms say they have been at a disadvantage in competing with those who use machines, and who did not give their men 10 per cent. This has led to a more general adoption of machinery, and other manufacturers are certain to go the same way. There are certain files that must be cut by hand, and it has been declared that no machine yet invented has been able to turn out the quality. For the range of files and rasps most largely used, however, the machines now in operation are well able to manufacture all that is required. This trade is busy, and the men are certain of full work during the winter.

The disturbances in Constantinople are having a disastrous effect on the trade in that quarter. The Armenians in that city are the commercial link between the producer and the consumer, and without them commerce is impossible. Several of our Sheffield houses have an important connection with Constantinople, from which they also do a large Levant and general Asiatic trade. That has been entirely stopped during the recent deplorable outbreaks, and no improvement can possibly take place until the political clouds clear off and the principal business men return to their ordinary avocations. On the other hand, the successful expedition to the Soudan is regarded with great hopefulness as restoring that vast region once more to civilisation and commerce. Prior to its lapsing into savagery, an excellent business was opening up through Egypt with these regions, and now it is expected that commerce will speedily follow on the heels of the Egyptian advance under efficient British control.

The Sheffield Smoke Abatement League has appointed the Earl of Wharncliffe as president, with Mr. C. H. Bingham as chairman, of an influential local committee. A resident inspector is to be appointed to carry on the work of the league under the direction of the committee.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

In almost all respects trade in this district continues to show progress, and especially is this so in the finished iron and steel branches, which have hitherto moved very little. But there is now a good demand, as consumers are anxious to secure supplies without delay, for they are satisfied that prices must be higher, if only to cover the increasing cost of production. Materials are becoming dearer. Most manufacturers have this week put up their quotations for finished iron 2s. 6d. per ton, and are able to realise the advanced rates. Some of the bar makers have never had a busier time, and they are in the unusual position of being able to refuse orders, owing to their inability to execute them within the time stipulated. Some have contracts booked which will keep them fully employed over the rest of the year, and for common iron bars they quote £5 2s. 6d., and best bars £5 12s. 6d., both less 2½ per cent., and f.o.t. There is certainly more animation in the plate trade and better prospects, as the advances in freights and the fuller employment for steamers are bringing in more orders for new vessels to the shipbuilders. Some idea of the improvement in shipping is afforded by the fact that whereas on the Tyne there were nineteen vessels laid up at the beginning of September there are now only ten, a smaller number than has been reported for over two years, and with the rapid advances of freights, there is a good chance of substantial profits being realised. Steel ship plates have been put up to £5 2s. 6d.; iron ship plates to £5; steel ship angles to £5; and iron ship plates to £4 17s. 6d., all less 2½ per cent., and f.o.t. In the steel trade the almost certain increase in cost of production is as great a factor as anything in raising of selling prices. Ore freights have risen substantially, causing the price of ore itself to advance, and though as yet no increase in the price of hematite pig iron has been made, that must follow, as must also some further rise in the value of steel plates and angles, the makers of which are already partly anticipating the advance, especially as they are so well supplied with orders now. The rail trade continues very active, and the price of heavy steel rails is steady at £4 10s. net at works. Iron founders have advanced their prices for railway material, and ask £3 10s. for cast iron bowl chairs, and £3 for ordinary cast iron chairs, both net at works.

Though makers have not sold a great deal of pig iron this week, they are delivering an unprecedentedly large tonnage, and have some difficulty in satisfying the needs of consumers at home and abroad, more particularly the latter. Never in the history of the trade has there been such a heavy production of pig iron, and never have deliveries been so extensive. There can be no doubt that the present output, large though it is, is not equal to the existing requirements, and stocks have to be drawn upon very freely. The official returns have not yet been issued for September, but it is estimated that the consumption of Cleveland pig iron will have exceeded the production by 25,000 or even 30,000 tons, and there are makers who are sanguine enough to predict a still greater decrease of stock. Such a decrease as even the lowest of the figures named above is remarkable, when it is considered that it occurs when the make is the largest ever known.

There can be no question of the activity of the pig iron trade in the North of England, more particularly if the shipments also be taken into account, and it is surprising that better prices than now rule are not realised. The exports of pig iron from the Cleveland district in August exceeded the previous best by nearly 10,000 tons; but those of September have been 14,681 tons better than those of August, the quantity exported being 133,442 tons, as compared with 118,761 tons in August, and 95,310 tons in September, 1895. They are thus by much the best on record. In an average September about 80,000 tons of pig iron are exported, and therefore last month exceeds the average by over 66 per cent. It is apparent that the Cleveland ironmasters have largely extended their foreign trade this year and last, for prior to the end of 1894 there were only five months on record when the export reached 100,000 tons; whereas this year, in six months out of the nine, that quantity has been exceeded, and in several cases largely exceeded. The decrease

of Cleveland iron in Connal's stores during September was 17,121 tons, the quantity held at the close of the month being 164,788 tons. Of hematite pig iron Messrs. Connal at September 30th held 153,296 tons, and the decrease for the month was 3879 tons.

Practically there has been no advance in the prices of Cleveland pig iron, except grey forge, which is up to 3d.; and No. 3 is kept at 38s. for early f.o.b. delivery, with no business at any figure reported below that. Some of the leading brands which are not to be found in the public warrant stores are being sold at 39s.; indeed, the makers thereof have disposed of considerable quantities at that figure. No. 4 foundry is at 37s., and grey forge 36s. 6d. It is surprising that hematite pig iron does not improve in price, when the cost of materials is going up. The rate of freight for ore from Bilbao to the Tees has advanced 1s. 3d. per ton during the last month, viz., from 5s. 3d.—at which it stood nearly all the summer—to 6s. 6d. and 6s. 9d., and even 7s. are now asked; and the tendency is still upwards, as owners have found other more profitable work for their steamers. The advance already made in freights is equivalent to an increase of 2s. 6d. per ton in the cost of producing pig iron, but no alteration has been made in the selling price, 45s. 9d. being still the rate for M. Nos., as it has been for a considerable time. Mediterranean ore freights have increased in greater ratio than the Bilbao figures. Rubio ore, which for a long period stood at 12s. 6d. per ton, delivered at Tees wharves, has now risen to 13s. 6d. and in some cases 14s. per ton, and merchants are in no hurry to quote for forward delivery, as the tendency is still markedly upwards.

Mr. Waterhouse's statistics for July-August, supplied to the Board of Conciliation and Arbitration for the Manufactured Iron Trade of the North of England, may be looked upon as satisfactory. They show that in that industry the improvement so far has been mainly in the demand, and that values have but very slightly increased. The March-April figures for 1895 were the worst that have ever been reported as regards the deliveries, and compared with that period the demand has increased 41 per cent., but realised prices as compared with the worst have only improved 1½ per cent., the total increase being under 2s. 10d., of which 9½d. only has been gained this year. The average price was in July-August 7·63d. per ton better than in the previous two months, and reached £4 17s. 1·18d. Iron rails went up 1s. 8·71d.; plates, 3·06d.; bars, 8·56d.; and angles, 1s. 3·11d. The finished iron trade this year appears to have taken a fresh lease of life; last year the manufacture was falling off at a great rate, and only 78,418 tons were delivered during the first eight months of the year; but this year the quantity for the corresponding period has been 94,244 tons, the chief improvement being in bars, now the most important department of the finished iron trade, as will be seen by the following summary drawn up by Mr. Waterhouse of the deliveries during the two months ending August 30th by firms connected with the Conciliation Board.

Description.	Weight invoiced. tons cwt. qr. lb.	Percentage of total.	Average net selling price per ton. £ s. d.
Rails	561 9 0 4	2·26	4 9 9·65
Plates	9,329 1 0 3	37·55	4 14 0·66
Bars	11,607 5 3 12	46·72	5 0 5·79
Angles	3,347 4 1 18	13·47	4 15 1·06
	24,845 0 1 9	100·00	4 17 1·18

Wages at the Northern mills and forges, which are regulated by this return, will not be altered for the next two months, as £4 17s. 6d. will have to be reached before an advance can be declared. No alteration has been made in wages since December, 1894, when 2½ per cent. reduction was announced. Wages at some of the Scotch finished ironworks are regulated by this return, but the men there are just now refusing to be guided by the North of England prices, as they say that Scotch prices are higher.

The wages of Consett steel makers are regulated by a sliding scale based upon the average price realised by the Company for steel plates. Mr. Waterhouse, the accountant to the Conciliation Board, has taken out the price for the last three months, and the secretaries of the Board announce that no change will be made in wages during the three months ending December 31st next. Other steel works in the North of England base their wages on the Consett fluctuations.

Sir Michael Hicks-Beach, the Chancellor of the Exchequer, is to visit the Tees on the 14th at the invitation of the Tees Conservancy Commissioners, who will show him the improvements they have effected in the river.

The coal trade is somewhat busier than it was, but the steam coal business is by no means equal to what it should be at this time of the year, and some of the Northumberland collieries are working rather badly, while 8s. per ton, f.o.b., has to be taken for best qualities. Gas and bunker coals are in fair request, and coking coal pits are fully employed. At the Murton Colliery, belonging to the South Hetton Coal Company, the East pit has been flooded through the breakage of one of the metal plates, 4ft. by 3ft. and 6in. thick, with which the shaft is lined. This also stopped work at two other pits, and 2000 men and boys were idle in consequence. However, another plate having been fixed, work has been resumed at the other two pits, but it will be some weeks before the East pit is cleared of water. The Haswell Colliery, like the Rainton Collieries, has been stopped because of unprofitable working.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow pig iron market was closed on Monday in consequence of a local holiday. At the opening on Tuesday a fairly good tone prevailed, and since that time the feeling has, upon the whole, been steady, fluctuations in prices being unimportant. The tendency is firmer for pig iron warrants. A week ago the market was inclined to give way in consequence of a lack of speculative business, but the favourable state of the manufacturing branches has put additional strength into the business this week. Scotch warrants have been done at 46s. 2½d. and 46s. 3d. cash, and 46s. 5d. one month. Cleveland iron has been firmer in consequence of the large shipments from Middlesbrough, business taking place in this market at 38s. 1d. and 38s. 2d. cash, and 38s. 4d. one month. More attention is given to hematite warrants in consequence of the advance in the prices of ore, and transactions in Cumberland warrants have been 47s. 1d. to 47s. 2½d. cash, and 47s. 5d. one month.

The market for Scotch makers' iron is steady to firm, consumers taking good and constant supplies. Govan, Monkland and Carnbroe, Nos. 1 are quoted 47s. 6d.; Nos. 3, 46s.; Clyde, No. 1, 49s.; No. 3, 47s.; Calder and Summerlee, Nos. 1, 50s.; Nos. 3, 47s. 6d.; Gartsherrie, No. 1, 50s.; No. 3, 48s.; Coltness, No. 1, 52s.; No. 3, 49s.; Glengarnock, at Ardrossan, No. 1, 49s. 6d.; No. 3, 45s.; Eglinton, No. 1, 47s.; No. 3, 45s.; Dalmellington at Ayr, No. 1, 46s. 6d.; No. 3, 44s. 6d.; Shotts, at Leith, No. 1, 52s.; No. 3, 48s. 6d.

The foreign demand for Scotch pig iron shows no improvement. The total shipments in the past week, coastwise and abroad, have been 5955 tons, compared with 7595 in the same week of 1895. There was despatched to Canada 100 tons, South America 30, India 20, Australia 345, France 100, Italy 500, Germany 972, Holland 910, Belgium, 30, China and Japan 660, other countries 218, the coastwise shipments being 2070, against 4781 in the corresponding week of 1895.

The output of pig iron is fully maintained, there being 78 furnaces in blast, compared with 76 at this time last year, and of the total 43 are producing ordinary, 34 hematite, and one basic iron. Twelve months ago there were 52 furnaces making ordinary pigs, and the number is now reduced to 43; but, on the other hand, there were only 19 furnaces producing hematite at this time last year, while the number is now increased to 34.

Special attention is directed to hematite pig iron by the advance in ore prices. From various quarters there has been in the last week or two an increased demand for ore in anticipation of the additional export charges coming into operation at Bilbao with the beginning of October. Simultaneously with this extra demand, there has occurred a scarcity of readily available steam tonnage, so that freights have risen, and the general result is an advance in Spanish ore, of which probably we have not yet seen the end. As noted above, the prices of Cumberland hematite warrants have been rising, and in West Cumberland there is an indication of higher prices being wanted. In the West of Scotland, merchants still quote for Scotch made hematite 49s. 6d. per ton, delivered free on trucks at the steel works, but the Scotch makers are bound to feel the effects of the rise in the Bilbao market quite as much as any other district. But for the fact that shipbuilding orders have of late been unsatisfactory, the hematite market would by this time have been considerably higher. In the last few days a number of fresh contracts for vessels have been announced, but several of the shipyards on the Clyde are becoming very bare of work. The steel makers have hitherto been largely dependent on the shipbuilding trade, and are so still, although the demand for bridge work and other material has lately been growing in a very marked degree. It only requires a rather better demand for ships to bring about a firmer market for hematite and steel.

A movement of considerable importance affecting the finished iron and steel trades is now taking place among the operatives in the West of Scotland. For a long time the wages of ironworkers have, by mutual consent of masters and men, been regulated by the course of prices in the North of England. When the official accountant in the latter district reported that the selling prices of manufactured iron warranted an advance of wages, an increase was also given in the West of Scotland, and adverse reports were productive of decreased wages. This arrangement has for long been a great convenience in Scotland, and has undoubtedly obviated many a dispute. It is not one, however, that has commended itself to the union leaders; it made the men too independent of their services. And so it has come about that the agreement is being denounced as unjust, and an agitation is going forward among the Scotch ironworks to have it terminated. The men are told that while trade has been languishing in the North of England, there has been a great development of it in the West of Scotland, and that they are accordingly being unfairly treated by the employers. The agitators allege that there have been three advances in prices of Scotch manufactured iron without any corresponding increase in wages. The North of England report, just issued, states that the prices realised there do not admit of any increase of wages during the next two months, and this circumstance will no doubt give additional point and force to the agitation in the West of Scotland.

Owing mainly to stormy weather, the coal shipments at Scottish ports have fallen off to a considerable extent in the past week, the clearances amounting to 152,414 tons, against 169,891 in the preceding week, and 165,865 in the corresponding week of last year. In Fifeshire the demand has been quiet, and in Ayrshire there is no improvement since last week. The tone is a little more satisfactory in Glasgow market, where prices are inclining upwards.

During September twenty-two vessels were launched from the Clyde shipyards, aggregating 34,000 tons, compared with thirty vessels and 35,000 tons in the same month of last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Welsh coal trade cannot be characterised as in a prosperous state, for though large quantities are exported this is chiefly due to the important contracts which were entered into some time ago. Going thoroughly into the situation, impelled to do so by the complaint on 'Change, Cardiff, that present business is slack, I find that many collieries are working in anything but a satisfactory manner. Last week, for example, in the Rhondda Valley, indifferent working occurred in the Ferndale and the Tylorstown Collieries in the lesser Rhondda. These employ about 7000 men. There is a rumour too that the Maindy Colliery, one of the Ocean collieries, is to stop to allow of sinking to the deep. Here 1200 colliers are employed. Mardy Collieries are fully employed. As of the Ocean, the Bwllfa is still affected by the contention of the workmen as to the proper price for working the seams, and of the two collieries in the neighbourhood stopped lately, I hear that some of the plant is to be raised. Last week, on account of the floods, the Albion was compelled to stop, the bursting of a canal sweeping away a great length of the railway embankment; so until this was repaired no wagons could be brought to the colliery. Coming on to Dowlais and neighbouring collieries, here the gale in the Channel, affecting the coming in of tonnage, has told seriously, and stopped collieries, for a time, more or less, have been ordinary features.

The return last week of the shipment of coal from Cardiff ports was 50,000 tons below the average, the total barely exceeding 250,000 tons. The Swansea collieries have been fairly busy, Ystalyfera, Primrose, and Glyntawe; Grongola moderately brisk. Newport and Monmouth shipments indicate a tolerable shipment on foreign account, coastwise slack; demand for semi-bituminous active. Midweek coal conditions at Cardiff were not improved, the report on 'Change being to the effect that there was a good deal of flatness in the market, and little demand for prompt shipment. What with dullness of trade, and the severity of the gales interfering with shipping, the outlook for steam coal is at present gloomy. House coals are reported in good demand for inland trade, but for shipment, owing to the scarcity of tonnage, easier. Latest Cardiff prices are: Steam coal, best, 10s. to 10s. 3d.; seconds, 9s. to 9s. 3d.; dry, 8s. 9d. to 9s.; special small, 5s. to 5s. 3d.; best ordinary, 4s. 6d. to 4s. 9d.; inferior, 3s. 9d. to 4s. 3d.; best house coal, 10s. to 10s. 6d.; No. 3 Rhondda, 10s. to 10s. 3d.; brush, 9s. to 9s. 3d.; No. 2 Rhondda, last prices, but demand restricted, large selling at 7s.; through, 6s. to 6s. 3d.; small, 4s. to 4s. 9d.; small of No. 3 Rhondda is firm at 7s. 9d. to 8s. 3d., f.o.b.

The colliers' plan for preventing underselling is now published, and is in form much the same as given last week in The Engineer. Mr. D. A. Thomas, in conversation with a local authority, objected to anticipate his pamphlet on the prevention of underselling by giving a forecast and he also declined to give an opinion of the new scheme. Some of the leading men on 'Change, Cardiff, are not so reticent, and their opinions are of value. One of the objections cited was, "there are no two collieries alike. Each coalowner thinks his coal better than that of his neighbour. One colliery is known better than another, and can command a better price. One colliery is at the top of the Rhondda, another eight miles nearer port." Then there is the question of output, the identity of seams, one contending that his is the 4ft., another that it is the 6ft. Another leading coalowner remarks that it will be impossible to fix a minimum price. Yet another, "the scheme is utterly impracticable. You will never get the coalowners to fix the value of the different sorts of coal." The only remedy, in the opinion of this gentleman, was reducing the output, either by the owner stopping or the men absenting themselves a couple of days a week. This scheme, however, for restricting output reminds one of the attempt in the tin-plate district to restrict make. There it failed. Doubtless the condition of things is amended by action from within the trade; an over-make, like an over-output, brings about a glut and falling prices, and the weaker man goes to the wall, and then conditions improve.

Swansea coal quotations mid-week were as follows:—Steam coal 9s. to 10s.; seconds, 8s. 3d. to 9s.; bituminous coal, 9s. 6d. to 10s.; through coal, 8s. 6d. to 9s.; small, 6s. 9d. to 7s. 6d.; anthracite, best, 11s. to 11s. 3d.; seconds, 9s. to 10s.; ordinary, 8s. to 8s. 9d.; patent fuel, 9s. 9d. to 10s.

Cardiff prices, best, 10s. to 10s. 3d.; seconds, 9s. 9d.; trade moderately good. Coke remains in good demand, Cardiff, but upward movement is not so marked owing to large make.

Pitwood, Cardiff, sluggish prices, 14s. 6d. to 14s. 9d. Iron ore brisk, prices improving.

Tenders are being solicited for the Gower Iron and Tin-plate Works, near Penclawdd, Glamorgan. The forge contains fifteen puddling and three balling furnaces, three steam hammers, &c. &c. The tin-plate mills is reported to be very complete, with a new vertical compound condensing engine, and a horizontal high-pressure.

I regret to have to announce the death of Mr. E. Beddoe, of Llancaiach, colliery owner. He was associated with his late brother, Mr. William Beddoe, in opening out a good area of the well-known Mynyddislwym coal.

The mechanics of Ebbw Vale Iron and Steel Works came out on Saturday, after giving only one week's notice. The men number 100, and are affiliated with the Amalgamated Society of Engineers. Their wages are 19s. 5d., and in some cases 21s. I understand they demand 25s.

The iron and steel trades continue in a tolerably satisfactory state, though so far without any change worth noting in price. As regards wages, the meeting a few days ago of the Sliding Scale Committee in the trade decided that the audit would not allow of any change. In the Swansea district most of the works are busy; the Landore tin-plate, Swansea blast furnaces, Milbrook steel and engineering works are all brisk. At Dowlais the whole of the mills and furnaces are in active operation, and there is no fear of further stoppage. At Cyfarthfa there is a good deal of pig iron in stock, and the make of steel rails has been brisk, though a large quantity is stocked for shipment. A novel consignment from these works, where the make of steel rails is a novelty, took place this week in the form of a larger quantity of rail ends for Cwmfran.

Large consignments are now in course of steel rails, tin bars, and small goods from Dowlais. On 'Change, Swansea, this week it was reported that there was a falling off of orders for rolling galvanised sheets in the Midlands. Quotations this week were as follows:—Pig iron, Glasgow warrants, 46s. 2d. cash buyers; Middlesbrough, No. 3, 38s.; hematite, 45s. 3d.; Welsh bars, £5 10s. Iron and steel plates, £6 10s. to £6 15s.; steel rails, heavy, £4 12s. 6d.; light, from £5 12s. 6d.; Bessemer steel bars, £4 5s. to £4 7s. 6d.; Siemens tin-plate bars, £4 10s. Tin-plates: Bessemer cokes, 9s. 9d. to 10s.; Siemens, 10s. to 10s. 3d.; ternes, 17s., 18s., 22s.; best charcoal, 13s. 9d. to 14s. Block tin, £55 17s. 6d. to £58.

The tin-plate trade continues in a doubtful position, much depending upon the action of the men this week. If notice be given, and not withdrawn at the end of October, it means another of the calamitous events which have so frequently occurred in this trade, as leading makers say that the granting of 1874 prices is a sheer impossibility. The price of raw materials has gone up, without a corresponding advance in price per box, and if many are not working even now at a loss, they are making no profit. The block will only benefit one body, the Americans.

Briton Ferry mills and several in the Swansea district have been busy. Last week the shipment of plates was 59,314 boxes, make at works 57,267 boxes. Notices are to hand of great damage to shipping all along the coast, and Port Talbot works at North pier injured.

NOTES FROM GERMANY.

(From our own Correspondent.)

The accounts that come in from the various districts concerning the position of the iron and steel trades are all very favourable. Inquiry is brisk, and a full employment is reported at the different establishments.

A good, healthy business is transacted on the Silesian iron market, and there are indications of a further stiffening in quotations, demand having steadily improved during the last weeks. All sorts of raw iron meet with a lively request, and for malleable iron numerous orders of considerable weight are constantly being secured; the confident tone of the market has consequently been well maintained. A specially satisfactory trade is done in plates of all descriptions, the continually improving foreign demand having materially influenced the condition of prices, which may now be considered as altogether remunerative.

A fair amount of business has, in the course of the week, been transacted on the Austro-Hungarian iron market, the different sorts of structural iron remaining in particularly good call. The hardware trade also appears to be developing quite satisfactorily. Official quotations are:—For white forge pig, 45 to 50 fl.; grey ditto, 48 to 51 fl.; Bessemer, 48 to 51 fl.; ingots, 76 to 80 fl.; bars, 115 to 120 fl.; plates, 142·50 to 165 fl.; heavy plates, for boiler-making purposes, 160 to 180 fl., according to quality; tank plates, 130 to 135 fl.; girders, 111·50 to 125 fl., all per ton. Tin sheets, 26 fl. per box; galvanised sheets, 210 to 265 fl. p.t.

The French iron market has been very steady upon the week. Pig iron sells briskly at fair prices, and for malleable iron there is a large and regular inquiry. The steel works and construction shops are particularly active, and have very good prospects for further orders. Material changes in quotations cannot be reported; in a few instances slight advances have taken place.

On the Belgian iron market the tendering for railway material for the State Railways was the most interesting event of the week, and it is worth mentioning that the works as a rule have been asking considerably higher prices; sectional iron No. 3, for instance, which was offered at 144f. to 146f. p.t. last year, now fetching 168f. p.t.; plates No. 3 realised 184f. to 200f., against 168f. p.t. The supply of the last-named article was granted to a French works. Changes in the favourable condition of the different departments of the Belgian iron and steel trade are not likely to take place for some months to come. Exports have been rather heavier of late; some large orders for tubes were secured quite recently. Latest quotations for home consumption are:—Girders in iron or steel, 125f. p.t.; bars No. 2, 137·50f. p.t.; plates in iron, No. 2, 150f. p.t.; the same in steel, 160f. p.t. Ingots cost 97·50f. p.t.; blooms, 110f. p.t.; billets, 120f. p.t.; scrap iron, 60f. to 65f. p.t. at works. Girders for export quote £5 4s. p.t.

The principal feature of the Belgian coal market is a quiet firmness, which will, most probably, change into briskness and an upward tendency, as the demand for house coal begins to increase. Up to date prices for common small coal are 6·75f. to 9f. p.t.; best small coal, 7f. to 9f. p.t. House coal, best sorts, 12·75f. to 15f. p.t.; second quality, 9f. p.t.

Here and there slight advances in notations are reported to have taken place since last week, although, as a rule, list rates are firmly maintained, but not surpassed. The total production of pig iron in Germany, including Luxemburg, is statistically stated to have been, during August of present year, 539,440 t., of which 135,903 t. were forge pig and spiegeleisen, 46,166 t. Bessemer, 280,784 t. basic, and 76,587 t. foundry pig. Output for July 1896 amounted to 539,776 t. From January 1st to August 31st of present year, 4,175,021 t. were produced. The physiognomy of the malleable iron business continues very bright, and there has not been any slackening off in demand as yet; on the contrary, orders as well as inquiries have been numerous during the past week and activity in all branches is as brisk as ever. Girders and plates in iron and steel remain in vigorous demand; bars, too, meet with a fair request generally. Tubes are in exceedingly good call; gas pipes, both black and galvanised, have been slightly raised in quotation. In wire rather a small trade is being done and the prices obtained leave a very small profit only. With regard to the employment of foundries and machine factories the favourable accounts that have previously been reported can only be repeated this week. According to the *Rhenish-Westphalian Gazette* the tonnage of coal entering at the harbours of Rulwort and Duisburg was, for the first eight months of present year, 80,458,720 cwt., against 64,316,840 cwt. for the corresponding period last year, the tonnage clearing at the same harbours amounting to 79,903,400 cwt., against 63,347,340 cwt. last year. Shipments of coal up the Rhine during the first eight months of present year were 13,346,000 cwt. higher than in 1895, while down the Rhine 3 million cwt. more were sent this year than last.

THE PATENT JOURNAL.

Condensed from "The Illustrated Official Journal of Patents."

Application for Letters Patent.

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

16*th September*, 1896.

20,516. Oil Lamps, E. Eagles, E. Skelt, and A. G. Evans, London.
20,517. A Honeycomb Frame Crock, G. Wintle, London.
20,518. Hosiery, E. E. Bowen, London.
20,519. Pen Holders, F. E. Potts and E. A. Forbes, London.
20,520. Apparatus for Punching Paper, G. M. Gibson, London.
20,521. Manufacture of Yeast, A. L. Burlin, London.
20,522. Disintegrating Mills, &c., C. L. A. Schütze,
20,523. Slow Combustion Grates, &c., A. Pampus, London.
20,524. Bags and Sacks, W. H. Beck.—(*C. D. Orth, United States.*)
20,525. Tandem Cycle Frames, W. Cross, London.
20,526. Pipe Wrenches, T. Lumsden and M. Brown, London.
20,527. Horseshoes, W. Nehrhaupt, London.
20,528. Treatment of Hemorrhoids, G. Mendel, London.
20,529. Production of Acetylene, G. S. T. Gastine, London.
20,530. A New Grip Brake, H. J. Seguin, London.

17*th September*, 1896.

20,531. Folding Card, C. W. Faulkner and E. C. Walrond, London.
20,532. Facilitating the Cleaning of Tubes, A. Stirling, London.
20,533. Producing Paintings on Canvas, L. Mayar, London.
20,534. Combination Show Box, W. Wells, Redhill, Surrey.
20,535. Speed Indicators, T. D. Wilson and W. E. Baker, London.
20,536. Automatic Reverse Lock, D. James, Pontypridd.
20,537. Matches and Cases, A. G. Manifold, Liverpool.
20,538. Crutches or Artificial Limbs, J. Ronan, Sligo.
20,539. Apparatus for Signalling, R. Burn, A. C. Brown, and L. G. Tate, London.
20,540. Wood-smoothing Planes, G. E. Puttergill, Beeston.
20,541. Four-cylinder Engines, R. H. Smith, Birmingham.
20,542. A New Steamer or Boiler, R. W. Ward, London.
20,543. Garments for Cyclists, R. Gibson, Dundee.
20,544. Gearing of Cycles, &c., W. B. Henderson, Glasgow.
20,545. A New Game, W. Allan, jun., Glasgow.
20,546. Grips or Clips, E. Eaves and A. J. Tonge, Keighley.
20,547. Handle for Velocipedes, J. Warry, Birmingham.
20,548. Stove Raker, D. Gillies, Bonnybridge, Stirlingshire.
20,549. Slag Distributor, T. C. Sargeant, Northampton.
20,550. Gas Governors, J. W. Crichton, Glasgow.
20,551. Sharpening Knives of Reaping Machines, J. Tippett, Bristol.
20,552. Air to be Burned in Lamps, H. Niemeyer, Berlin.
20,553. Apparatus for Playing Games, H. Marles, Brighton.
20,554. Rims and Pneumatic Tires, P. M. Staunton, Dublin.
20,555. Golf Clubs, J. Reeves, London.
20,556. Motor Car, F. W. Norridge and W. J. Taylor, Southampton.
20,557. Brakes, C. Greenwood, Keswick.
20,558. Dress Guard, J. F. Friday, Coventry.
20,559. Bird Trap, F. Larkin, Cheshire.
20,560. Cycle Tool Bags, J. S. Crowley, Manchester.
20,561. Combing Wool, J. Delattre, Manchester.
20,562. Oil Lamps, C. L. Jackson, Manchester.
20,563. Bolts, H. F. Murphy and J. Barker, Manchester.
20,564. Pressure Reducing Valves, G. Cockburn, Glasgow.
20,565. Cranes, A. Menzies, Glasgow.
20,566. Power Wheel, J. Barrett, Felpham, Sussex.
20,567. Sheaf Binding Harvesters, E. Samuelson, Oxon.
20,568. Pneumatic Tires, T. H. Ramsden, Bramhope, near Leeds.
20,569. Finishing Textile Fabrics, &c. W. Ward, London.
20,570. Attaching Dress Guards, J. Biddle, Birmingham.
20,571. Wheels of Cycles, B. J. Hammersley and C. Wilcox, Birmingham.
20,572. Locking Rest for Bicycles, W. K. Wyley, near Stafford.
20,573. Pumping or Raising Liquids, J. Keith, Glasgow.
20,574. Window Sashes, R. Bell and T. Flynn, Glasgow.
20,575. Necktie or Scarf Retainers, J. Parsons, London.
20,576. Assisting Learners to Ride the Bicycle, J. W. Dyer, London.
20,577. Fronts of Jackets, G. H. Thomas and B. Whitworth, London.
20,578. Non-slipping Device, V. Barrett-Lennard, London.
20,579. Electric Time-hadicap Starter, W. Nichol, London.
20,580. Umbrella Runners, W. A. Bindley, W. J. Gell, and A. F. Boham, London.
20,581. Inflatable Tires, H. Godsal, London.
20,582. Elastic Chains, C. Moritz and H. J. Drane, London.
20,583. Atmospheric Gas Burners, R. Burns and W. Gardner, London.
20,584. Self-propelled Vehicles, &c., W. Lattey, London.
20,585. Device for Lifting Hay-cocks, R. Sheane, London.
20,586. Automatically Closing Gates, E. Holden, London.
20,587. Horse Manure Receptacle, E. Whitlock, London.
20,588. Transmitting Rotary Power, J. A. Drake, London.
20,589. Jointing Telescopic Rods, E. W. Shackell, London.
20,590. Smokers' Hold-all Appliance, J. Middleton, London.
20,591. Tire Protector, H. L. McKellops and E. O. Cochrane, London.
20,592. Steam Generator, J. and J. Seedhouse, jun., Sheffield.
20,593. Shoeing Horses, H. G. Hogg and E. Plows, London.
20,594. Motor Cars, J. P. O'Donnell.—(*P. A. T. de B. de Bourzac*, ——.)
20,595. Driving Gear of Cycles, &c., R. J. Meek, London.
20,596. Fitting Unfinished Garments, A. J. Hawes, London.
20,597. Dress Guards for Cycles, W. Shirley, Birmingham.
20,598. Treatment of Calcium Carbide, J. A. Deuther, London.
20,599. Producing Acetylene Gas, J. A. Deuther, London.
20,600. Electrodes, J. A. Deuther, London.
20,601. Electric Furnaces, J. A. Deuther, London.
20,602. Acetylene Gas, W. B. Rickman.—(*J. Pintsch, Germany.*)
20,603. Drying Cement, G. G. M. Hardingham.—(*F. D. Cummer, Belgium.*)
20,604. Electrical Resistances, W. M. Mordey, London.
20,605. Axles for Horseless Carriages, G. Delannoy, London.
20,606. Crate for Holding Bicycles, E. Vincent, London.
20,607. Pneumatic or Cushion Wheels, W. R. James, London.
20,608. Lamps for Burning Acetylene Gas, R. Türr, London.
20,609. Pneumatic Tires for Wheels, F. Pegler, London.
20,610. Stands for Bicycles, C. A. Hindley, London.
20,611. Paper Files, A. Thomann, London.
20,612. Artificial Stone, P. Kleber, London.
20,613. Fishing Nets, J. Ball, London.
20,614. Incandescence Oil Lamp, &c., G. Kron, London.
20,615. Obtaining Metals, &c., A. J. Boult.—(*Koehler*, ——.)
20,616. Railway Traction, W. P. Thompson.—(*A. Luzi, Italy.*)
20,617. Mineral Water Boxes, &c., J. Davies, Liverpool.
20,618. Globe, R. K. Balcarras, London.
20,619. Sprinklers, J. Edge, Manchester.
20,620. Terminals, J. Kandt.—(*The Firm of Töpffer and Schüdel, Germany.*)
20,621. Drive Chain, A. Appleby, Birmingham.
20,622. Distributing Vapours, G. B. Ellis.—(*La Société Chimique des Usines du Rhône, anciennement Gilliard P. Monnet et Cartier, France.*)

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20,623. Gearing for Motor Car Wheels, F. Windham, London.
20,624. Shuttles for Looms, &c., G. W. Crawshaw, Gomeral.
20,625. Cranes, H. C. Walker and C. W. Hildred, London.
20,626. Incandescent Gas Lamp Fittings, F. S. Cripps, Sutton.
20,627. Road Locomotives, T. B. Marchant, London.
20,628. Roller Ship or Vessel, T. Connor, Glasgow.
20,629. Taking-up Motion for Looms, A. E. Walker, Halifax.
20,630. Gearing Device for Cycles, &c., J. Jackson, Coventry.
20,631. Automatic Valvular Vent Peg, J. Atkin, Manchester.
20,632. Brake, H. B. Jagger, Southport.
20,633. Inflating Pumps, A., F., and A. Rousseau, Manchester.
20,634. Folding Screen Cheval Glass, W. Hill, Manchester.
20,635. Stockings, W. R. Walker, Leicester.
20,636. Cycle Pedals, J. Taylor, Rochdale.
20,637. Taps, R. H. Hepburn, Birmingham.
20,638. Invalid Guard, C. M. Woods, London.
20,639. Sock or Pad for Boots and Shoes, S. H. James, London.
20,640. Tobacco Pipes, T. H. Simmonds, London.
20,641. Explosive Cartridges, &c., W. Norris, Farnworth.
20,642. Tobacco Pipes, H. Gray, Bradford.
20,643. Pneumatic Tires, C. Leslie, Liverpool.
20,644. Pneumatic Tires for Cycles, &c., J. Munn, Birmingham.
20,645. Reaping and Mowing Machines, G. King, Stockton-on-Tees.
20,646. Wooden Frames for Cycles, J. Whitehead, Birmingham.
20,647. Coiling Machine for Metal Wire, T. Weir, Dublin.
20,648. Golf Clubs, R. Ramsbottom, Manchester.
20,649. Venetian Blinds, G. A. J. Schott, Bradford.
20,650. Cockspur or Casement Fastener, P. Fraser, London.
20,651. Envelope, D. McK. McKinlay, Polmont, N.B.
20,652. Using Tidal Rise and Fall, D. McK. McKinlay, Polmont, N.B.
20,653. Automatic Safety Hoist Catch, J. Abbott, Leeds.
20,654. Horse Nosebag Suspender, W. S. Dougall, Nottingham.
20,655. Engines for Auto-cars, &c., J. Wilkinson, Birmingham.
20,656. Boots, &c., C. Hickmann and G. Mellor, Birmingham.
20,657. Double Speed Gearing for Cycles, L. Charniaux, Brussels.
20,658. Sleeve Extenders, T. W. and M. Marsters, Nottingham.
20,659. Handles of Bicycles, &c., T. B. Sharp, Birmingham.
20,660. Inserting Rubber Tires, G. Wearing, Birmingham.
20,661. Window Sash Fastener, J. Entwistle, Manchester.
20,662. Cork and Bung Lifter, L. J. Powell, Pembroke Dock.
20,663. Pneumatic Tire for Bicycles, R. J. W. Down, Bristol.
20,664. Holders for Bell Watches, E. Taylor, Birmingham.
20,665. Door Fastener, A. R. Eungblut and E. Crouch, London.
20,666. Teaching Freehand Drawing, G. Pettinger, London.
20,667. Making Clothing for Horses, C. C. Forrester, London.
20,668. Lubricators, J. C. W. Kjelgaard, London.
20,669. Pneumatic Tire Covers, J. W. Griffiths and J. Fitzsimins, London.
20,670. Stands or Supports for Music, E. Thomson, London.
20,671. Baker's Ovens, J. Melvin, Glasgow.
20,672. Covers of En-tout-cas Parasols, E. L. T. Bottone, Surrey.
20,673. Ribbing Textile Fabrics, W. R. D. Sharpe, London.
20,674. Embarking Ladders for Ships, H. K. and E. K. Scott, London.
20,675. Cartridges for Blasting, M. Bielefeldt, London.
20,676. Making Colouring Matters, O. L. Wilt, London.
20,677. Connecting Braces to Garments, E. L. Evens and A. Bonnin, London.
20,678. Locking Handle Bars of Cycles, W. and E. Allday, London.
20,679. Soldering Aluminium, H. Facer, London.
20,680. Collapsible Heads for Tripods, W. F. Butcher, London.
20,681. Cork Tire with Steel Covering, G. G. Astley, London.
20,682. Mud Guards for Cycles, J. Fletcher, Birmingham.
20,683. Fasteners for Wearing Apparel, H. Kleinmann, London.
20,684. Polishing Silver Ware, H. M. Hollingworth, London.
20,685. Penholders, J. Fitzgerald, London.
20,686. Lemon Squeezers, F. R. Miner, London.
20,687. Blackboards, K. L. Wemmell, London.
20,688. Tie Plates, F. Lindquist, London.
20,689. Improved Sashes for Windows, A. A. Benton, London.
20,690. Clutches for Variable Speed Devices, A. W. Southey, London.
20,691. Improved Wrappers for Bottles, J. J. Hinde, London.
20,692. Cycle Driving Gear, W. Robins and F. W. Finch, London.
20,693. Making Cements Whiting, C. O. Trechmann, London.
20,694. Storing Acetylene Gas, W. P. Thompson.—(*V. I. Comucci, Italy.*)
20,695. Photographers' Refining Stove, D. R. Van Riper, Liverpool.
20,696. Wristbands for Mittens, &c., J. Rigg, Birmingham.
20,697. Vinyldiacetonalkamine, A. Zimmermann.—(*The Chemische Fabrik auf Actien vormals E. Schering, Germany.*)
20,698. Increasing the Diameter of Rings, J. Hollis, London.
20,699. Improved Saddles or Seats, T. H. Simmonds, London.
20,700. Fastener for Shoe Laces, W. H. Craven, London.
20,701. Picking Motions for Looms, G. Needham and W. B. White, Lancashire.
20,702. Improved Hammers, J. Jacks, Ipswich.
20,703. Saddles for Velocipedes, J. G. Ingram, London.
20,704. Draw Gear, A. Spencer, London.
20,705. Library Card Catalogue, G. H. Willetts.—(*C. E. Scarse, England.*)
20,706. Toothed Gearing, A. B. Cruickshank, London.
20,707. Coating Tubes by Electro-disposition, J. Greenwood, London.
20,708. Bogie Trucks, G. Polack and A. Koppel, London.
20,709. Wheel Tires, H. Price, London.
20,710. Sewing Machines, P. Tracy, London.
20,711. Bicycle Driving Gear, A. T. Collier, London.
20,712. Water Taps, J. H. Austin, London.
20,713. Burning Liquid Hydro-carbons, J. L. Waldapfel, London.
20,714. Mercerising Vegetable Substances, R. Thomas and E. Prevost, London.
20,715. Kaolin Filtering Apparatus, O. Schaller, London.
20,716. Improved Drying Kiln, A. Müller, jun., London.
20,717. Diamond Polishing Machines, A. J. Boult.—(*A. Wauters, United States.*)
20,718. Improved Cinder Sifter, &c., N. Haxell, London.
20,719. Connecting Tent Doors, C. W. Dawson.—(*S. M. Johnson, India.*)
20,720. Improved Dish for Soap, J. A. Clapham, London.
20,721. Driving Gear of Cycles, H. M. Smith, London.
20,722. Starting Switchback Carriages, J. W. Cawdery and W. J. Hale, London.
20,723. Wheel Tires, J. H. Stewart, London.
20,724. Dowelling Machines, A. G. W. Bern, London.
20,725. Barrel Manufacturing Machinery, A. G. W. Bern, London.
20,726. Manufacturing Barrels, &c., A. G. W. Bern, London.

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20,727. Sunshades, Parasols, &c., J. W. Beattie, London.
20,728. Cloth Fabrics, W. H. Symington, London.
20,729. Paper Bag, H. Edwards, Torquay.
20,730. Preventing the Puncture of Pneumatic Tires, E. E. Ellis, London.
20,731. Skewer Extractor, W. J. G. Massey, Birmingham.
20,732. Decreasing Wool Cotton Waste, G. E. Wright and W. Monk, Manchester.
20,733. Purification of Liquid Sewage, J. B. Petrie, Rochdale.
20,734. Opening Windows Inwardly, A. Cameron, Glasgow.
20,735. Pneumatic Tire for Wheels, J. Robertson, Glasgow.
20,736. Improving the Colour of Raw Jute Fibre, C. O'Brien and J. Shearer, Glasgow.
20,737. Improving the Colour of Raw Jute Fibre, C. O'Brien and J. Shearer, Glasgow.
20,738. Handles for Golf Clubs, M. R. Cauch-Kavanagh, Glasgow.
20,739. Attachment for Fanlights, G. F. Newman, Birmingham.
20,740. Cycle, &c., Lamps, C. A. and F. J. Miller, Birmingham.
20,741. Lamps for Cycles, C. A. and F. J. Miller, Birmingham.
20,742. Tools for Removing Pneumatic Tires, A. H. Townsend and P. J. Quinn, Newport, Mon.
20,743. Tilt Flusher for Water-closets, D. Boyce, London.
20,744. Brick Carrier Stacker, &c., J. Hayes and W. H. Hollier, Aberystwith.
20,745. Actuating Switches, R. P. Stevenson.—(*E. H. B. Tyler, South America.*)
20,746. Steam Engines, J. Hardill, Halifax.
20,747. Velocipedes, &c., S. Gorton, W. Taylor, and The New Beeston Cycle Company, Coventry.
20,748. Pipes for Cooling Apparatus, A. Konried, Manchester.
20,749. Stoppering Bottles, S. Duffield, Glasgow.
20,750. Lamps for Cycles, E. M. Harley, Glasgow.
20,751. Bottles, J. and A. F. Lewis, London.
20,752. Brushes, J. Leatherbarrow, Liverpool.
20,753. Treatment of India-rubber, H. Millington and T. H. Parry, Liverpool.
20,754. Actuating Spring-closed Valve Gear, C. Scott and H. Hodgson, Manchester.
20,755. Lubricating Composition for Bearings, C. Bilton, Glasgow.
20,756. Corsets, H. Macaulay, Glasgow.
20,757. Securing together Cranks and Sprocket Wheels, &c., H. F. Vale and R. J. Fowkes, Birmingham.
20,758. Automatic Brakes, J. W. Milligan and F. Oldfield, Birmingham.
20,759. Internal Combustion Engines, A. W. Southey, London.
20,760. Cork Tires for Bicycles, &c., M. Twomey, Cork.
20,761. Non-slipping Tires for Vehicles, G. C. B. Atkinson, London.
20,762. Wire Cutters, G. C. B. Atkinson, London.
20,763. Printing Colours on Sacks, J. G. Kinmond, D. P. Kidd, and D. J. MacDonald, Dundee.
23,764. Centrifugal Machines, R. Williamson, Glasgow.
20,765. Bedsteads, W. Orr, Glasgow.
20,766. Skeleton Speed Chain, J. E. Morris, Brecknockshire.
20,767. Pneumatic Tire for Wheels, J. S. Helyer, Southsea.
20,768. Photograpic Shutter, G. Houghton and W. A. Edwards, London.
20,769. Bicycle Folding Handle Bar, A. Merrick, Manchester.
20,770. Wrenches, C. A. Allison.—(*P. Hathaway, United States.*)
20,771. Manufacture of Saccharine Compounds, H. Helbing, London
20,772. Broaches, &c., Tools, P. Saacke, London.
20,773. Production of Vapours of Formic Aldehyde, J. J. A. Trillat, London.
20,774. Folding Beds, E. M. Antisdel, London.
20,775. Graters, J. S. Sobey, London.
20,776. High-pressure Taps for Water or Steam, F. A. Small, London.
20,777. Whist Markers or Scorers, S. Betjemann, London.
20,778. Safety Attachments for Suspended Wires, J. Aldworth and J. Shaw, Liverpool.
20,779. Capes, &c., C. Parker and J. Meadowcroft, Manchester.
20,780. Apparatus for Fire-places, J. Roberts, Liverpool.
20,781. Lubricator, A. Smith, Birmingham.
20,782. Neckties, E. C. Schoeler, London.
20,783. Handles for Velocipedes, F. W. Ingram and J. H. P. Deag, London.
20,784. Foot Warming Appliances, H. J. Thaddeus London.
20,785. Manufacturing Printers' Leads, F. Ullmer, London.
20,786. Signalling Apparatus for Railways, L. B. Stevens, London.
20,787. Manufacture of Real Lace Tulle Blonde Trimmings, J. de V. M. y Llorca, London.
20,788. Target for Gun Practice, W. J. S. Barber-Starkey, London.
20,789. Fog Signalling Apparatus, T. Moseley, London.
20,790. Chimneys, M. Strüdel, London.
20,791. Combing Machines, H. E. Newton.—(*La Société Alsacienne de Constructions Mécaniques, Germany.*)
20,792. Sheep Dip Powder, W. O., T. O., O., and W. B. B. Quibell, London.
20,793. Pneumatic Brake for Wheels, T. R. Mudie, London.
20,794. Manufacturing Thorium Hydrate, B. Kosmann, London.
20,795. Bicycles, J. T. Cheetham and J. W. Waters, Manchester.
20,796. Electric Railways, H. H. Lake.—(*R. Lundell, United States.*)
20,797. Crank and Pedal Mechanism for Cycles, W. Inglis, Glasgow.
20,798. Construction of Cycles, C. J. Fauvel, London.
20,799. Nails for Boots, &c., J. Radcliffe and F. E. Baggaley, Manchester.
20 800. Stretching Boot Uppers, J. S. Marshall and J. Bowler, London.
20,801. Raising Doors on their Hinges, E. Edwards.—(*C. Hisgen, Germany.*)
20,802. Embroidering Loom Lathe, J. C. Blanchard, London.
20,803. Finishing Boots, F. Butters, London.
20,804. Funnel with Air Tube Attachment, W. E. Morton, Liverpool.
20,805. Protecting Electric Circuits, V. A. Fynn, London.
20,806. Rotary Grinding Mills, J. Heinstein, London.
20,807. Built-up Sheets of Veneer, C. McCallum, London.
20,808. Wheels with Elastic Tires, T. C. J. Thomas and E. C. Steavenson, London.
20,809. Pneumatic Tires, T. C. J. Thomas and E. C. Steavenson, London.
20,810. Detachable Puncture-proof Pneumatic Tire, M. and B. Trigg, Kent.
20,811. Conversion of Reciprocating Motion, L. S. Crandall, London.
20,812. Bicycles, L. S. Crandall, London.
20,813. Sculptured Images, W. P. Thompson.—(*A. Bontempi, Italy.*)
20,814. Looms for Weaving, J. Ward, Halifax.
20,815. Preventing Punctures in Pneumatic Tires, G. Roy, Manchester.
20,816. A Composite Tire for Cycles, G. Roy, Manchester.
20,817. Retaining False Teeth in Position, H. Macaulay, Glasgow.
20,818. Manufacture of Magnesia, M. N. d'Andria, Stretford, Lancashire.
20,819. Gear for Bicycles, J. H. Ross, Birmingham.
20,820. Shaving and Similar Brushes, C. Davies, Liverpool.
20,821. Wheel and Chain, A. J. Reed and A. Lanning, Dorset.
20,822. Recovery of Hydrochloric Acid, M. N. d'Andria, Stretford, Lancashire.
20,823. Cycle Foot Rests, T. and H. Hamer, Nottingham.
20,824. Rotary Tipplers, H. Clark and J. M. Ringquist, and the firm of Head, Wrightson, and Co., Stockton-on-Tees.
20,825. Friction Clutch, J. M. Ringquist, H. Clark, and Head, Wrightson, and Co., Stockton-on-Tees.
20,826. Trousers' Clip, F. Bölian.—(*W. L. Barber, United States.*)
20,827. Coat-shaping Machine, S. Taylor, Huddersfield.
20,828. Drawing Corks from Bottles, J. Relf and A. Glover, Liverpool.
20,829. Coin Freed Machine, T. W. Rees, Cardiff.
20,830. Beaded Edge of Cattle Troughs, S. M. Wilmot, Bristol.
20,831. Flexible Photographic Films, A. P. Okell, Bowdon.
20,832. Opening Ventilators of Vehicles, C. Brawn, London.
20,833. Hot Air Cooking Stove, H. Bennett, Darlington.
20,834. Coulter for Ploughs, A. Kell and A. Gwillim, Gloucester.
20,835. Stamped Wheels, F. Johnson and D. McCallum, Cardiff.
20,836. Brakes for Bicycles, A. Hoyle, Bishop Auckland.
20,837. Street Lamps, J. Stewart, London.
20,838. Recovery of Metallic Copper, W. Noad and R. J. Lightfoot, London.
20,839. Bicycle Brake, C. Mundy, Farnborough, Hants.
20,840. Cycle Saddle Seating, S. W. Whitmore, Peterborough.
20,841. Preventing Waste of Water, A. B. Milne, Birmingham.
20,842. Cycle Forks, L. Heath and H. P. Trueman, Handsworth, Staffs.
20,843. A New Railway Sleeper, E. Ruttkowski, Glasgow.
20,844. A New Inkstand, T. Eichhorn, Manchester.
20,845. A Tramway Spike, D. McK. McKinlay, Polmont, N.B.
20,846. Vessels for Dyeing Purposes, &c., B. Lee, Leeds.
20,847. Machinery for Motor Cars, W. R. Smith, London.
20,848. Sleigh Car Railway Fire Escape, F. Hale, Twickenham.
20,849. Chain with Interchangeable Parts, J. A. and R. D. Reynolds, Belfast.
20,850. A New Pneumatic Tire, P. Wigley, Birmingham.
20,851. Piano, J. G. Gibb, Glasgow.
20,852. Polishing Spindles, G. F. Chutter, Birmingham.
20,853. Governor for Velocipedes, B. P. Olsson, London.
20,854. Improved Pneumatic Tires, A. Münden, London.
20,855. Pencil Cases, W. Ficher and C. A. Nicolaus, London.
20,856. Facilitating the Inflation of Tires, K. King, London.
20,857. Apparatus for Conjuring, W. H. Brett, London.
20,858. Rotary Engines, Pumps, &c., A. W. R. Berr, London.
20,859. Improved Pneumatic Tires, C. Stotesbury, London.
20,860. Recording the Passage of Trucks, S. Morse.—(*A. Woodhouse, Australia.*)
20,861. Gear for Bulkhead Doors of Ships, R. Baird, Glasgow.
20,862. Mud Guards for Cycles, E. J. Woodward, London.
20,863. Furniture Castors, R. Cartwright, V. E. James, and J. Jones, London.
20,864. Automatic, &c., Meters, F. M. Staulton, London.
20,865. Pneumatic Tire, G. Wackerbath and C. Mandell, London.
20,866. Treating Crude Steel, B. K. Jamison, London.
20,867. Vehicle Wheels, C. L. Schwarz, London.
20,868. Handle Bars for Velocipedes, G. D. Moffatt, London.
20,869. Bringing Wines to a Desired Temperature, C. Fischer, Liverpool.

20,870. An Improved Puzzle Toy, E. P. Lehmann, Liverpool.
20,871. Combined Closing Inkstand, H. M. Clark, London.
20,872. Elastic Tires for Bicycles, W. Theodorovic, London.
20,873. Bungs, J. J. Perrow, A. J. Newton, and M. King, London.
20,874. Cycle Driving Mechanism, H. G. Harris and W. Blackmore, London.
20,875. Saddles, A. W. Brittain, London.
20,876. Combined Walking Stick, A. B. von Hammer-Purgstall, London.
20,877. Artificial Lighting Apparatus, A. Salmon, London.
20,878. Belts, A. A. Curry, London.
20,879. Paper-pulp Apparatus, W. H. Stobie and W. H. Cunningham, London.
20,880. Grain Machine, W. H. Beck.—(*Oreste, Bendetti, and Scaratti, Italy.*)
20,881. Means for Protecting Conductors, V. G. Middleton, London.
20,882. Fishing Rod Accessories, E. R. Calthrop, London.
20,883. Recovering Cyanides, G. P. Lewis and R. A. Cripps, London.
20,884. Utilisation of Small Coal, W. H. Coward, London.
20,885. Device Relating to Ties, C. T. Griffin, London.
20,886. Door Securing Apparatus, P. O. Griffiths, London.
20,887. Saddles, J. H. Snow.—(*W. H. Craig, United States.*)
20,888. Bottles, R. G. Bidwell, London.
20,889. Drills, E. H. Atkins, London.
20,890. Horseshoes, A. Pearsall, London.
20,891. Baking Powders, F. Dietrich, London.
20,892. Weighing Apparatus, C. Ingrey, London.
20,893. Automatic Time Bolt, &c., W. A. Goode, London.
20,894. Fluid Pressure Generation, D. D. Esson, London.
20,895. Combustible Compound or Fuel, D. D. Esson, London.
20,896. Life-saving Communications, A. B. Cunningham, London.
20,897. Pneumatic Tires, R. F. and J. A. Rimmington, London.
20,898. Chromo-photography, V. Vaucamps, London.
20,899. Velocipede Suspender or Clip, P. O'Neil, London.
20,900. Machinery for Shaping Corks, J. E. Howard, London.
20,901. Window Show Cases, &c., A. Vintras, London.
20,902. Lamp Mechanism, P. R. Jackson and Co. and L. C. H. Mensing, London.
20,903. Gas Manufacture Apparatus, V. Sardi, London.

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20,904. Disinfecting Apparatus, R. Goehde and H. Oppermann, London.
20,905. Cycle Gear, J. Murrie, Glasgow.
20,906. Cash, &c., Tills, N. Collins and C. J. Fawel, London.
20,907. Telescopic Sliding Wedge, E. T. Burling, London.
20,908. Rotary Engines, S. Quincey, London.
20,909. Raising Sunken Ships, F. E. Shean, London.
20,910. Sharp Pointed Rails, M. Spier, Birmingham.
20,911. Apparatus for Cycle Brakes, E. Roe, Nottingham.
20,912. Pneumatic Tires for Cycles, G. A. Miller, London.
20,913. Recording Messages, &c., W. F. Gilcriest, Dublin.
20,914. Piston, M. F. Ross, London.
20,915. Puncture Finder for Cycles, S. S. Field, London.
20,916. Tapping Barrels, J. Taylor and W. Beattie, Halifax.
20,917. Automatic Tumbler Block Hook, R. B. West, Cowes.
20,918. Jacquards of Weaving Looms, P. B. Walker, Halifax.
20,919. Lace Wearing Apparel, H. Cooper, Nottingham.
20,920. Mounting Card Clothing, A. Hitchon, Accrington.
20,921. Cycle Chain, E. Tavernier, London.
20,922. Improved Wardrobes, S. Brentnall, Manchester.
20,923. Cycle Saddles, J. Byrom, Liverpool.
20,924. Fittings for Sliding Sashes, G. Herbert, Cheltenham.
20,925. Transmitting Motive Power, J. D. Bell, Glasgow.
20,926. Speed Governors for Motors, S. E. Alley, Glasgow.
20,927. Steam Engines, T. and W. H. Smith and W. Eastwood, Bradford.
20,928. Bayonet Stem Pipe, J. P. Rigby, Barrow-in-Furness.
20,929. Working Signals, A. Fahie.—(*R. S. Glover, India.*)
20,930. Supporting Devices for Cycles, W. Lowe, Leicester.
20,931. Method of Advertising, W. B. Ballantine, jun., Glasgow.
20,932. Manufacture of Gutta-percha, F. Fenton, London.
20,933. Cycles, R. S. Deane, Liverpool.
20,934. Artists' Canvas, L. Schmidt and P. S. McMillan, London.
20,935. Transmission of Motion, J. G. A. Kitchen, Manchester.
20,936. Ladies' Cycle Dressguard, T. Latham, H. Tustin, and T. Frost, Coventry.
20,937. Pneumatic Tires, W. Simpson, Birmingham.
20,938. Method of Prevention of Back Draught in House Fire-places, T. Common, Newcastle-upon-Tyne.
20,939. Spring Tire, T. Holmes, W. J. Watson, and J. Taylor, Nottingham.
20,940. Adjustable Index for Reading Rooms, Dr. H. Wade, Manchester.
20,941. Buckle Eyelet, J. B. Brooks, jun., Birmingham.
20,942. Securing Cranks on Cycle Axles, J. A. Ross, Glasgow.
20,943. Trawlers, J. Kay, Glasgow.
20,944. Hay Heaping Machine, J. G. Turner, Penrith.
20,945. Bicycles, A. Wex, Halifax.
20,946. Disposal of Water, J. V. Chitty and C. Provis, Emsworth.
20,947. Tires, G. Lamb. London.
20,948. Cycle Brakes, E. Bailey and A. C. Day, West Bridgford.
20,949. Sprocket Wheels, J. Doherty, Birmingham.
20,950. Watch and Bell, J. L. Reynolds and F. C. White, Birmingham.
20,951. Auto-car Driving Gear, W. S. Ross and W. Alexander, Glasgow.
20,952. Steam Traps, A. Bradshaw, Accrington.
20,953. Embrocation for the Cure of Gout, I. Ortman, London.
20,954. Pillars, E. Taylor, Birmingham.
20,955. Springs, W. Corteen, A. H. Adcock, and J. Birch, Birmingham.
20,956. Pneumatic Tires for Cycles, T. F. A. Ash, Birmingham.
20,957. Postal Wrapper, G. Barnes and F. P. Stevens, Birmingham.
20,958. Fixing Tires to Rims of Wheels, E. C. Wild, London.
20,959. Vulcanising Apparatus, P. J. Davis, London.
20,960. Cleaning Fibres of Plants, C. Junge.—(*S. B. Allison, United States.*)
20,961. Electric Lamps, J. T. Lister and W. S. Chamberlain, London.
20,962. Electric Railways, J. T. Rossiter and the British Electric Traction (Pioneer) Company, Ld., London.
20,963. Switches. J. T. Rossiter and the British Electric Traction (Pioneer) Company, Ld., London.
20,964. Current Collectors, J. T. Rossiter and the British Electric Traction (Pioneer) Company, Ld., London.
20,965. Lamps for Use as Signals, F. L. Rovedino, London.
20,966. Attachment for Lamps F. W. Dunlap and J. R. Quain, London.
20,967. Elastic Heel, B. Loderer and L. Barcsai, London.
20,968. Furnaces, A. F. Kingsley, London.
20,969. Coverings of Electric Cables, H. Edmunds, London.
20,970. Protecting Cover for Umbrellas, A. Stanley, London.
20,971. Photographic Camera, R. Daeschner, Cologne, Germany.
20,972. Propelling Vessels, G. W. Price, London.
20,973. Waterproof Fabrics, L. Frankenstein, Manchester.
20,974. Waterproof Fabrics, L. Frankenstein, Manchester.
20,975. Decoration of Pottery, &c., C. Mountford, London.
20,976. Artists' Easels or Sketching Rests, A. H. Holland, Sheffield.
20,977. Driving Lasting Tacks, H. H. Lake.—(*E. B. Seaver, United States.*)
20,978. Exposing Pictures, A. Loscher and R. Klein, London.
20,979. Boots, L. Perron, London.
20,980. Spindle Supports for Spinning Machines, T. Gorman, London.
20,981. Producing Electric Currents, H. H. Lake.—(*N. Tesla, United States.*)
20,982. Distilling Apparatus, J. van Ruymbeke and W. F. Jobbins, London.
20,983. Railway Permanent Way, J. M. Spaulding, London.
20,984. Electric Brakes, The British Thomson-Houston Company, Ld.—(*A. F. Macdonald, United States.*)
20,985. Cycle and Vehicle Wheels, G. V. de Luca, London.
20,986. Chainless Cycles, L. Oberhammer and M. Gerstendörfer, London.
20,987. Variable Speed Gear, L. Oberhammer and M. Gerstendörfer, London.
20,988. Stake for Supporting Carnations, A. Porter, London.
20,989. Dove-tailing Machinery, T. J. Ryland, London.
20,990. Adding Machine, D. E. Felt and R. Tarrant, London.
20,991. Seeding Machines, L. M. Jones and W. F. Johnston, London.
20,992. Method of Mounting Incandescence Mantles on Gas-burners, H. H. Lake.—(*W. H. A. Sieverts, Germany.*)
20,993. Fastening of Neckties and Bows, S. Lever, London.
20,994. Waterproof Bicycle Case, E. W. Toulmin, London.
20,995. Boot Trees, H. R. Bridson, London.
20,996. Gas Stove, F. H. Davisworth, London.
20,997. Steering Mechanism for Safety Bicycles, J. T. Scarborough, London.
20,998. Umbrellas, T. T. Wee, London.
20,999. Frames for Cycles, J. W. Holland and A. Anthony, London.
21,000. Gloves, J. M. Mason, London.
21,001. Flat Bar Knitting Machines, C. H. Aldridge, London.
21,002. Reproduction of Pictures, &c., J. H. Player, London.
21,003. Speed-retarding Appliances for Electricity Meters, R. P. Wilson, London.
21,004. Washing Bottles, &c., C. Wenigmann, London.
21,005. Bottle-filling Machines, R. J. Cousins, J. W. Flower, and A. P. Prout, London.
21,006. Seat Supports of Chairs, P. Jensen.—(*Gilson Manufacturing Company, United States.*)
21,007. Removing Scale from Boiler Tubes, W. D. Forsyth and E. T Bell, London.
21,008. Cicatures, M. Gaffy, London.
21,009. Low-tension Dynamo Electric Machinery, F. E. Elmore, London.
21,010. Filters for Wines, W. Elze, London.
21,011. Manufacture of Pure Yeasts, G. E. Jacquemin, London.
21,012. Extraction of Silver from Ores, A. J. C. Nettel. London.
21,013. Furniture Castors, W. T. Reay, London.
21,014. Domestic Turkish Bath, &c., J. Thomas, London.
21,015. Method of Exhibiting Photos, C. H. Daniell, London.
21,016. Watch Keys, W. Butler, London.
21,017. Bicycles, T. Cawley, London.
21,018. Making Tea, J. E. Gibson and J. E. Ayres, London.
21,019. Stoppering Bottles, S. Mundey, London.
21,020. Railway Signalling Device, P. W. Norfolk, London.
21,021. Can Openers, J. A. Haskett, London.
21,022. Treating Malt Liquors, &c., A. E. Feroe, London.
21,023. Feeding Bottles, W. E. Williams and R. Roderick, London.
21,024. Tires for Wheels of Bicycles, E. J. Byrne, London.
21,025. Connecting Rails, A. E. Woodhouse.—(*J. S. Woodhouse, New Zealand.*)
21,026. Saccharine, W. L. Wise.—*Chemische Fabrik von Heyden Gesellschaft mit beschrankter Haftung, Germany.*)
21,027. Electrolysis, W. L. Wise.—(*The Aluminium Industrie Aktien Gesellschaft, Switzerland.*)
21,028. Rolling Wire and Bars, &c., G. Lürmann, London.
21,029. Water Gauges, D. B. Morison, London.
21,030. Seals, F. W. Wood, A. M. Young, W. B. Hosmer, London.
21,031. Terebenthene Mono Hydro-chloride, J. G. McIntosh, London.

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21,032. Blinds for Carriage Windows, L. Lantheaume, London.
21,033. Cleaning Fruit, J. Parnall and Parnall and Sons, Ld., Bristol.
21,034. Steam Engine Air Pumps, F. Edwards, London.
21,035. Cycle Stands, W. H. Harvey, London.
21,036. Rudder Frames, F. S. Cormier and L. W. McAnn, Canada.
21,037. Inflator Clip, T. Hooper and S. G. Moore, London.
21,038. Recovery of Gold and Silver, W. Douglas, Glasgow.
21,039. Machinery for Making Confections, J. Robins, Glasgow.
21,040. Igniting Apparatus for Motors, S. Griffin, Bath.
21,041. Spanners, J. Ellis, Dublin.
21,042. Joining Railway Bars, H. E. J. Camps, Newcastle-on-Tyne.
21,043. Convertible Saddle Bar, J. Hartley, London.
21,044. Carving and Cutting Machine, C. Lafontaine, London.
21,045. Trousers Leg Protectors, O. Tietze, Manchester.
21,046. Alarm Bells, J. Kenyon and G. Whewell, Manchester.
21,047. Boots, W. Lacey, Leicester.
21,048. Soap, E. S. Wilson and E. Stewart, Liverpool.
21,049. Cash Tills, G. H. Gledhill, Halifax.
21,050. Gas Cooker, J. Wynn, Cardiff.
21,051. Mechanism for Driving Bicycles, D. Parry, London.
21,052. Bacon Suspender and Advertiser, J. Wynn, Cardiff.
21,053. Friction Clutches, N. Macbeth, Manchester.
21,054. Cooking Ranges and Fireplaces, J. Hardie, Manchester.
21,055. Electric Fittings, E. J. Piper, London.
21,056. Children's Carriages, T. Reeves and A. R. Andrews, Chatham.
21,057. Bottle which cannot be Refilled, F. W. Elliott, Durham.
21,058. Lamp Reflector, J. H. Fletcher, Derbyshire.
21,059. Bicycle Tires, E. W. Hughes, London.
21,060. Cleaning Filtering Material, A. P. Hope, Salford.
21,061. Disinfector for Street Manholes, &c., A. P. Hope, Salford.
21,062. Variable Speed Gear, A. J. Drake and J. S. Critchley, Coventry.
21,063. Steering Machinery, A. B. Brown, Glasgow.
21,064. Automatic Dough-weighing Machine, A. Graham, Manchester.
21,065. Cleaning Stair-rods, H. Dade, Essex.
21,066. Hair-pins, W. H. Cole, Birmingham.
21,067. Attaching Table Tops to the Frame, P. Daw, Birmingham.
21,068. Supports for Holding Soap, &c., W. M. Binns, London.
21,069. Coin-freed Gas Meters, H. and C. Gamwell and J. and J. Lind, Liverpool.
21,070. Strops, J. Rauter, London.
21,071. Indicating the Form of Competitors in Racing, T. Dykes, London.
21,072. Penholders, A. E. Sims, London.
21,073. Gauge Glass Protectors, J. Pennifer, London.
21,074. Woven Wire Mattresses, F. J. Maier, Birmingham.
21,075. Bed Bottoms, F. J. Maier, Birmingham.
21,076. Governor to Control Engines, T. J. Haslam, Dublin.
21,077. Detachable Cycle Mudguard, C. D. Weekes, Dublin.
21,078. Rod and Bracket Support, G. C. Lidstone, Swansea.
21,079. Ruler, F. Rowley, Manchester.
21,080. Brakes, J. J. Mennell, M. Brooks, and F. Richmond, London.
21,081. Producing Photographs, J. Slater, Manchester.

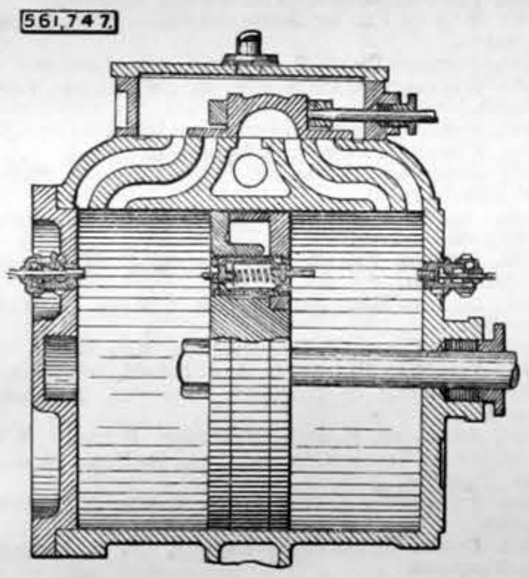
SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

561,747. Steam Dash Valve, *C. C. Worthington, Irvington, N.Y.—Filed July 3rd*, 1895.

Claim.—(1) The combination with a steam cylinder and piston, of a steam passage connecting the cylinder ends on opposite sides of the piston, a valve mechanism controlling said passage and under a constant pressure less than the steam pressure on the admission side of the piston tending to close the passage, and normally closing the passage during the stroke, and means for actuating said mechanism to open the passage at the desired point in the movement of the

561,747.

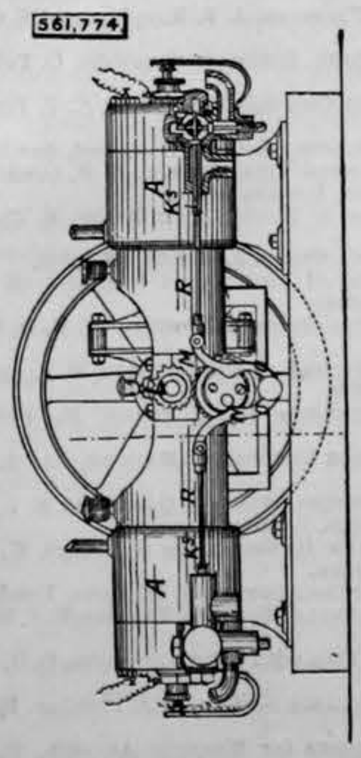


piston, substantially as described. (2) The combination with a steam cylinder and piston having a steam passage through it, of valves controlling said passage, said valves operating independently and opening from the opposite ends of the cylinder and seated by a constant pressure less than the steam pressure on the admission side of the piston, and means for opening the valve on the exhaust side of the piston at the desired point in the movement of the piston, substantially as described.

561,774. Gas Engine, *G. F. Eggerdinger and G. R Swaine, Cleveland, Ohio.—Filed August 3rd*, 1896.

Claim.—In a gas engine of the character described, the combination with the cy inders A, A, of the valve mechanism consisting of the valve body K having port k leading into the cylinders, chambered extension K^1 having valve seat k^1 and valves k^2, the chambered extension K^3 having valve seat k^4 and

561,774.

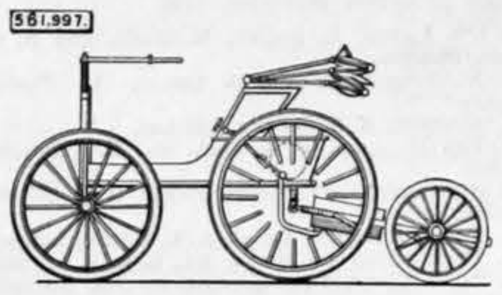


valve K^4, suction inlet port K^2 and exhaust port k^5, valve stems K^5, levers O, O, fulcrumed to hanger m and connected by rods R, R, to the valve stems, a pinion L on the crank shaft, gear M journaled on the hanger m and in mesh with the pinion, stud-pin N on said gear M, all constructed and adapted to operate substantially as described.

561,997. Motor Vehicle, *A. H. Kennedy, Rockport, Ind.—Filed December 20th*, 1895.

Claim.—(1) In combination, a road vehicle having a rigid rear axle provided with carrying wheels, a pivoted front axle provided with carrying wheels, and a hand steering gear connected with the front, pivoted axle, a separate motor attachment located in the rear of the vehicle, and pivotally connected with a rigid part of the frame thereof, said motor attachment comprising driving wheels, a supporting frame therefor, flexible connections between the motor frame and the frame of the vehicle, an engine on the motor frame, and mechanical connections between the engine and the driving wheels of the motor. (2) The combination with an ordinary road vehicle having front and rear wheels, and a hand steering gear connected with the front wheels, of a separate motor attachment located in the rear of the vehicle and pivotally connected with the frame thereof, said

561,997.

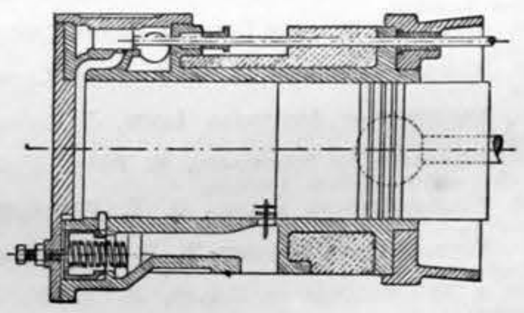


motor attachment comprising driving wheels, a supporting frame therefor, flexible connections between the motor frame and the frame of the vehicle, an engine on the motor frame, mechanical connections between the engine and the driving wheels of the motor, a fuel supply tank on the vehicle and connections between said tank and the engine of the motor.

562,039. Outlet Valve for Steam Engines, *W. Schmidt, Wilhelmshöhe, Germany.—Filed September 28th*, 1894.

Claim.—(1) In a steam engine, the combination with a main exhaust port situated so as to become uncovered by the piston at one end of its stroke, of an auxiliary exhaust port situated so as to become covered by said piston near the other end of its stroke; a valve adapted to close the outer end of said auxiliary port, and to be operated by the steam remaining within the cylinder, and compressed by the said piston after the latter has covered the inner end of the said auxiliary

562,039.

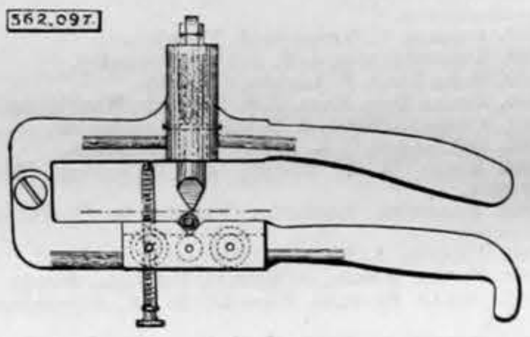


port; and a spring tending to keep said valve constantly open, for the purpose as described. (2) In a steam engine, the combination with a main exhaust port situated so as to become uncovered by the piston at one end of its stroke, of an auxiliary exhaust port situated so as to become covered by said piston near the other end of its stroke; a piston-like valve adapted to close the outer end of said auxiliary port, and to be operated by the steam remaining within the cylinder, and compressed by the said piston after the latter has covered the inner end of the said auxiliary port; and a spring tending to keep said valve constantly open, for the purpose as described.

562,097. Device for Removing Insulation from Electric Wires, *A. E. O. Rieckel, Brooklyn, N.Y.—Filed December 13th*, 1895.

Claim.—(1) The combination, with two pivoted handle levers, of which one is provided with a lateral wing, having a longitudinal groove and a transverse groove in its upper service, a socket extending upwards from the other lever, a blade mounted to move lengthwise in said socket and a spring in said

562,097.

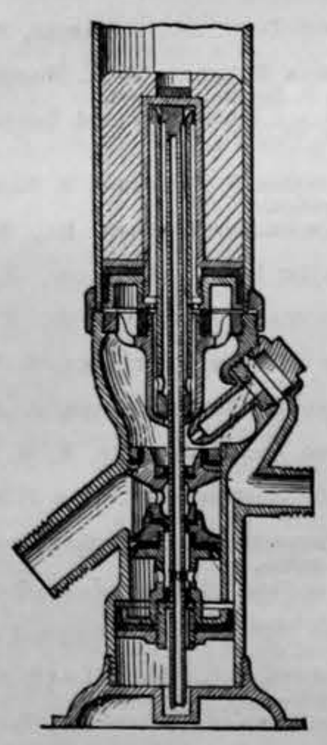


socket for pressing the blade downward with a yielding pressure, substantially as herein shown and described. (2) The combination with two pivoted handle levers, of a blade held in one and a wing on the other, which wing has a longitudinal and a transverse groove, crossing each other at right angles in the upper service of said wing, and rollers mounted in slots of the longitudinal groove, substantially as herein shown and described.

562,164. Hydraulic Air Pump, *E. H. Weatherhead, Cleveland, Ohio.—Filed July 26th*, 1895.

Claim.—(1) The main casing having an inlet port with an ejector nozzle and an outlet port below the inlet port, a valve seat between said ports and a valve formed with a circular portion to extend within said valve seat and having a lateral flange beneath said circular portion, substan-

562,164.



tially as set forth. (2) In a hydraulic air pump, a casing having a valve seat around about its inside wall and a water inlet on one side of said seat and a water outlet on the other side, a main valve constructed to enter said valve seat and close the passage, and an ejector nozzle in the water inlet forming a water passage from said inlet and pointed in the direction of the water outlet, substantially as set forth.