MODERN MILLING.—ITS BIRTH AND DEVELOPMENT.

By Gilbert Little.

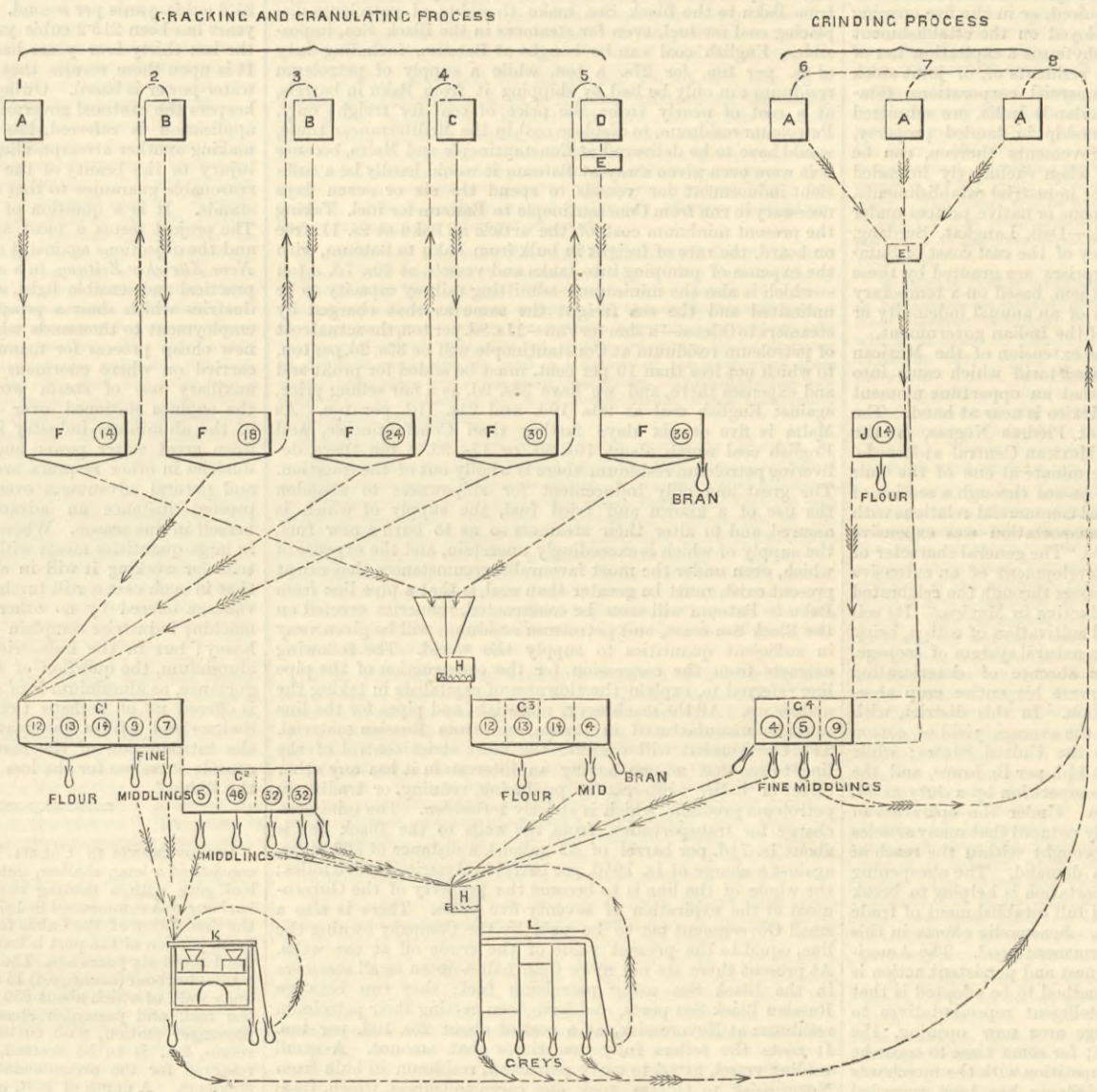
II.—THE FIRST COMPLETE ROLLER PLANT.

That "Necessity is the mother of invention," is an aphorism that is now largely discounted, and "Competition is the spur to invention," is now more widely recognised and affirmed. To competitive commerce is due that stimulus which improves arts and manufactures, and it was the imports of superior brands of Hungarian and American flours that led to improved milling in the United Kingdom. So long as competition is at a stand all appears satisfactory, and manufacturers as a class do not improve or adopt improvements on principle, but as a trade necessity. The ubiquitous little bag of American flour, which found its way into every village bakehouse, converted the majority of British and Irish millers into roller millers, and not the eloquence of the roller-milling experts. It was the sheer necessity of the case arising from competition that led to the British and Irish mills being entirely revolutionised within six years. In 1869, when the imports of Hungarian and American flours were almost *nil*, Mr. Buchholz preached the "break" system like one crying in the wilderness; but in 1881, when the imports of American flour had leaped up to five and a-half million sacks per annum, the words of the Simons, the Carters, the Childs, and the Throops fell upon willing ears, and "all men went out to them."

After the efforts of 1869-72—described in our last article—the desire to improve had ebbed in England; but the flow of the tide of roller-milling had gone on in America and Hungary. During the next ten years the gradual reduction and gradual purification system had extended itself on the Continent with a timidity which the proved value of the new process did not warrant. In 1880 Mr. J. H. Carter, Mr. J. W. Throop, and Mr. Buchholz, organised a large party of British and Irish millers to visit the mills of Buda-Pesth; but the flimsy-looking machinery and non-automatic systems did not impress the British visitors very favourably, and one or two of them actually built new mills on the old millstone system after their return from this trip. About the time this party were examining the improved continental mills an experiment was going on at Manchester which was destined to demonstrate the entire suitability of the roller system for British requirements. It was on the 16th day of August, 1878, that the first order for a complete roller mill plant, without the use of millstones, was given by Messrs. McDougall Brothers, of the City Mills, Manchester, to Mr. Henry Simon, of that city. As far back as 1820 roller mills, in combination with millstones, had been tried on the Continent; and Collier, of Paris, Bolinger, of Venice, and Helfenberger, of Switzerland, had designed and erected break roller mills. These machines did not succeed, and their failure was no doubt due to the want of middlings purifiers. The first roller-millstone plant on the Continent that could be called a success was the Pesth mill, started in 1867, or two years before Mr. Stannard's attempt. The Pesth mill had 210 pairs of rolls, arranged in five sections. Two of the sections were programmed for the production of middlings, and the other three assisted by millstones for the reducing of the middlings. This mill long enjoyed a monopoly for the finest grades of flour, and in the production of that flour now known as "Patents," the Hungarian millers undoubtedly achieved the first and most prominent success. It was in Hungary, too, that the high-grinding system was most successful, and it may be interesting to state here the peculiar way in which it was brought about. A large number of the mills in Buda-Pesth were run by current-wheels; that is, the water wheels stood out in the current, and in that way transmitted the power to the mills. It appears that at one time the water got extremely low—so low, indeed, that the mills could not be operated in the usual way. The wheat could not be reduced on the "sudden death" system, and as an expedient, the experiment of reducing the wheat gradually by the millstones was undertaken. The surprise of all who witnessed this experiment must have been as great as Mr. Muir's was when he found the flattened germs in his sieve, as the flour was of most excellent quality; and this discovery led to roller mills being tried in Buda-Pesth long before there were any kind of rolls in England or America. While some of the principles of roller milling were understood in Hungary early in this century, it was not till 1875 that the Hungarian flours attained a world-wide reputation, and it is doing the Hungarian milling experts no injustice to state that the progress they had made was only the starting-point from which the great development in British roller milling took its rise. The success of the Buda-Pesth mills led Mr. Henry Simon, of Manchester, to suggest to Messrs. McDougall Brothers that a trial might be made in their mills in Poland-street, which they agreed to carry out. For this purpose a combined roller mill and disc machine was ordered from a German maker in 1877 and tested at Messrs. McDougall Brothers' mills. This new machine gave fairly satisfactory results, such as seem to have induced Mr. Simon to propose and Messrs. McDougall Brothers to accept to make a further and more elaborate trial of a system of roller milling machinery on a small scale, and for this purpose the then newly-invented three-high roller mills—Daverio's patent—with friction relieving bearings were used. From the flow sheet of this, the first complete roller mill plant erected in the United Kingdom—which, through the courtesy of Mr. Simon, we are able to reproduce in The Engineer—it will be seen that it consisted of four fluted break roller mills with rolls 12in. long by 9in. in diameter. The centrifugal and semolina purifier, after a lapse of only nine years, already look as antiquated beside Mr. Simon's present superb machinery as the Rocket or Puffing Billy looks alongside Mr. Webb's, Worsdell's, or Johnson's most recent locomotive at the Manchester Exhibition, and the improvements in the present flow sheets followed by Mr. Simon are even more marked than are those made in the design of his machinery. While it must be understood that this first complete roller plant can only be looked at in the light of an entirely tentative attempt to adopt the complete roller process to the requirements of British and Irish millers, it is astonishing how well it succeeded in this respect. The results on purely English wheats—as well as on the most varied mixtures of English and foreign—were most surprising, especially at that time; and the author is aware that none of the subsequent, more elaborately programmed Simon or any other system mills have been such great commercial successes. This little tentative and purely experimenting plant met the millers' first aim—it made money. This mill was only semi-automatic, but it afforded very great facilities for gaining experience as to the points and difficulties which called for special attention in adapting the roller system to British and Irish requirements. From the outset it seems to have been Mr. Simon's aim to gradually improve as experience taught, and the rapid arrival at a high state of perfection may be due to his habit of considering every point of advance as only the starting-point to still greater progress, and it has been much to the advantage of modern milling that its greatest exponent has never believed in finality; as the industry or individual who acquires this feeling, as Edmund Burke said, "only suggests food for melancholy reflection."

A glance at the "flow-sheet" of the mill will show that the "chop" was spouted to a reel C^1, and the "break" flour dusted out, and it passed on to another reel C^2, where the fine middlings were dressed, which were ground without purification. The semolina from the reel was conveyed to the gravity purifier, and there was no other purification in the process. The tailings and outsiftings of the reels were caught, as shown, in sacks and fed on to the smooth rolls according to the judgment of the miller, and the material was ground over and over again till finished. This system of "returns" was undoubtedly the weak point in Mr. Simon's first attempt. The complete and most successful mills of the present day are those in which no part of the product goes through the same smooth rolls twice, but is carried forward and reduced on seven or eight different reductions. It is now seen that the real value of the smooth reducing rolls lies in the fact that they are purifiers at the same time that they are reduction machines. When smooth rolls are properly adjusted they reduce that portion of the liberated kernel of the wheat which should be reduced, and at the same time flatten the germ and do not triturate the internal impurities that are scattered throughout the semolinas, but leave them larger in size so that they can be dressed over the tail of the flour dusting reels, or less in specific gravity, which admits of their being separated by aspirators. But we are anticipating points that will be clear from our flow sheets of the perfected systems.

In a letter to the author dated November 30th, 1886, Mr. Arthur McDougall writes as follows, "In our little experimental mill, erected by Mr. Simon, we obtained a straight run flour of very good quality, and a little low grade flour from grinding the poor middlings. We did not take out any patent flour, as our straight run when compared with that made by other firms on the millstone system was so good that we got a good price for it and a large percentage, and that paid us better than a small percentage of patents at a higher price. The mill would not be able to hold its own now with the perfected roller plants, but at the time it was a very great improvement on ordinary grinding by millstones. After running this small plant for about six months we were more than convinced of the suitability of the roller system, and we introduced similar plants in our larger mills which continued in work five years, when we, through yourself, placed the order for the reconstruction of our mills to obtain the advantages of the improvements that had been made."



MR. SIMON'S FLOW SHEET OF THE FIRST COMPLETE ROLLER MILL PLANT.

Manchester has been the nursery-ground of many of the great industrial upheavals, and it can thus also lay claim to the honour of being the fountain-head of successful gradual reduction milling, and this first success was a fitting prelude to the abiding distinction which Mr. Simon and the Messrs. McDougall Brothers have attained. Mr. Simon was peculiarly fortunate in his first clients, as a new departure could not have been made with greater chances of success than under the skilful scientific eye of Mr. Arthur McDougall. In Mr. McDougall we have another proof of the fact that the greatest improvers of many industries are not the men nurtured in the particular branch of industry in which they rise to distinction. Mr. Arthur McDougall was brought up amid the mysteries of the chemist's laboratory, and did not turn his attention to milling until he had hit upon a chemical discovery which led to the production of the world-famous McDougall's self-raising flour. Free therefore from all the old prejudices of the school of millers who had been brought up in the pre-scientific days, his mind was open to receive conviction, and thus it was that one who was not a miller in the sense of having been brought up to the trade, had the honour of having the first complete roller plant in the United Kingdom. His training as a chemist had given him that power of tracing points to the root and finding any lurking defect, and it is to the scientific and progressive millers like Mr. Mc. McDougall that we owe much of the great advance in scientific milling, and not entirely to the energetic experts who have added their *fecit audi alteram partem*.

ABSTRACTS OF CONSULAR AND DIPLOMATIC REPORTS.

China—The Yangtze-Kiang River.—The United States Consul at Chinkiang reports:—"I have conversed with Consul-General Kennedy touching an examination of the Upper Yangtze River, so as to study the capabilities of that region for the extension of trade, and also with several of the leading American merchants of Shanghai, who desire additional markets and the development and promotion of trade in the interior. The Yangtze-Kiang is one of the greatest rivers of the world, has its source in Thibet, and flows through a fertile country 2000 miles to the sea. On

its banks are innumerable cities, towns, and villages, which are the outlets to populous regions in the interior. At Chunking, a populous city 400 miles above the rapids, merchants are not permitted to reside, or to open establishments or warehouses, so long as steamers have not access to the port. When steamers have succeeded in ascending the river so far, arrangements can be made for opening Chunking to trade. The explanation of this is, that just beyond Ichang, which is 360 miles above Hankow, the river runs through a series of huge gorges, and forms rapids, the possibility of navigating which by foreign-built steamers has never been tried. These rapids have been passed several times by native boats, and travellers are of opinion that they are navigable by small strongly-built steamers. There is only one rapid about a mile in length which offers any serious obstacle, and it is considered that this can be overcome without great difficulty. All the upper river country is described as being of great fertility and capacity for trade, and is perhaps the most populous portion of China, the province of Kiang-su having a population of 60,000,000."

Holland—Acquiring land in Sumatra.—Applications having recently been made for information as to the Dutch laws concerning the purchase of plantations in Summatra by foreigners, and whether foreigners can acquire land in Summatra, and under what conditions, the following information may be appreciated. In all that part of the island under the direct administration of the Dutch Government, the Governor-General is empowered to grant, on the request of the applicants, waste land on an emphyteutic lease for a term not exceeding seventy-five years, at an annual quit rent of 11½d. per acre. The application must be accompanied by a certificate of measurement of the lands selected. Lands granted on an emphyteutic lease are subject to a ground tax amounting to ¾ per cent. of its estimated value, but no ground tax or quit rent is levied in the year in which the land has been acquired, or in the five ensuing years. For every working man employed on the establishment in the service of the tenant by emphyteusis a capitation tax of 4s. 2d. a year is payable. None but residents of, or joint stock companies, or limited liability commercial corporations, established in the Netherlands or Netherlands India, are admitted as tenants by emphyteusis. Ownership in landed property, with the privilege of making improvements thereon, can be acquired only in small parcels, and when exclusively intended for the erection of dwelling houses or industrial establishments. In the provinces governed by indigenous or native princes under the sovereignty of the Netherlands—Deli, Langkat, Serdang, Seak, &c.—belonging to the residency of the east coast of Summatra, lands for agricultural enterprises are granted by these princes. The grants conferred by them, based on a temporary cession of the soil against payment of an annual indemnity or rental, are subject to the approval of the Indian government,

Mexico—Railway and tariff.—The extension of the Mexican International Railway, and the revised tariff which came into effect on the 1st of July last, show that an opportune moment for the commercial exploitation of Mexico is near at hand. The International Railway commences at Piedras Negras, on the Rio Grande, will connect with the Mexican Central at Laredo, 300 miles distant, and ultimately terminate at one of the Gulf or Pacific coast ports of Mexico. It passes through a section of country in the past having but limited commercial relations with the outside world, and in which transportation was expensive and slow. An American consul writes, "The general character of this country is favourable to the development of an extensive and lucrative commerce. The line passes through the celebrated Laguna valley, one of the most productive in Mexico. Its soil is peculiarly suited for the successful cultivation of cotton, being bountifully supplied with water by a natural system of seepage. Irrigation is unnecessary, and the absence of deteriorating influences enables the planter to harvest his entire crop absolutely free from discoloration or stain. In this district, with the primitive means of cultivation, the average yield of cotton per acre is 60 per cent. over that in the United States; while the cost of production if from ¾d. to 1¼d. per lb. lower, and the Mexican planter is protected from competition by a duty of 3d. per lb. on all foreign-grown cotton. Under the operation of the revised tariff, duties are so largely reduced that many articles of American manufacture will be brought within the reach of the poorer classes, thus creating a demand. The cheapening and increasing facilities for transportation is helping to break down the barriers to a complete and full establishment of trade relations on a lasting and sure basis. Spasmodic efforts in this direction will not accomplish any permanent good. The American merchant must realise that earnest and persistent action is necessary, and the most efficacious method to be adopted is that of sending active, earnest, and intelligent representatives to the Mexican market. In the large area now opening, the American should take the initiative; for some time to come he would not be brought into sharp competition with the merchants of the old world, whose unwearied vigilance has been rewarded by such rich harvests in the older and better settled parts of Mexico."

Russia—Use of petroleum fuel.—The great success in the use of petroleum residual fuel in the locomotives of the Grazi-Tsaritzin Railway has been followed by its adoption on several other lines, after adapting several locomotives to its use, so as to test it in comparison with other methods. The Grazi-Tsaritzin Railway uses for all its locomotives (143) stationary boilers (50), and in the shops, petroleum residuum. The following are the results from the use of petroleum residuum fuel in two types of locomotives used upon this railway in 1885, compared with results from the use of coal in 1882. The annual average result shows that by weight 1 lb. of petroleum was equal in effect to 1·78 lb. of coal :—

	6-Wheeled Engines.	8-Wheeled Engines.
Average consumption of coal per mile, 1882	57·25 lb.	81·43 lb.
,, ,, petroleum ,, 1885	32·23 lb.	46·63 lb.
Saved on petroleum against coal in weight, per cent.	43·70	43·68
Unproductive run of locomotives :		
With coal in 1882, per cent. of aggregate	35·25	15 85
With petroleum in 1885 ,, ,,	36·08	15·97
Average cost per mile :		
With coal	7¼d.	11¼d.
With petroleum	4¸d.	6½d.
Saved on petroleum against cost on coal, per cent.	42·35	43·13
Average yearly cost per ton :		
Of coal	£1 6s. 3d.	
Of petroleum	£1 6s. 4d.	

With such a considerable run as is made by the locomotives upon the Griazi-Tsaritzin Railway, the gross annual saving to the company from the use of petroleum residuum fuel in locomotives and stationary boilers, and from indirect saving in repairs, will be about £41,666. The comparative cost of running 1000 car axles per mile given below, from the official reports of the Griazi-Tsaritzin Railway, points to the great signification of petroleum fuel for railway purposes. The cost of running 1000 car axles per mile was in 1881, 18s. 5d.; in 1882, 17s. 2d.; in 1883, 16s. 9d.; in 1884, 11s. 6½d.; in 1885, 10s.; with coal, in 1882, 18s. 5d., and with petroleum residuum in 1885, 10s., or a saving of 46·7 per cent. Technical agents were sent from America and Italy to Borisoglebsk to study the system of petroleum burning, and it is now in use in America, Burmah, India, Italy, and several other countries, and even for torpedoes. Petroleum fuel has a great advantage over coal in those localities where coal is expensive and a cheap and sufficient supply of residuum is obtainable; but the price quoted for coal, £1 6s. 3d. per ton, is exceedingly high, and cannot be taken to compare the actual value of the two articles outside of Russia. The difference in the two articles of fuel residuum, 1·00, and coal 1·78, is much smaller than has heretofore been shown. That there is a doubt in the minds of those most competent to judge, even in Russia, as to the permanency of the present advantage of petroleum fuel over coal, even for use in the countries nearest the base of petroleum supply, will be seen by an extract from a speech delivered on 31st May last, before the Baku Technological Society, by Professor Mendelief, a leading Russian scientist, sent by the Russian Government last year to Baku to study the petroleum industry, and who is an enthusiast regarding it:—"The sale for petroleum residuum is definite; it will have the same sale in the future; but the country cannot base its manufactures on petroleum fuel, which is unknown and unguaranteed, while coal is known and guaranteed. At the present moment petroleum residuum is overthrowing coal, because of a lack of adequate transportation facilities from the Don coal-fields to the Volga country, from whence it would thrust itself to the manufacturing centres—the governments of Moscow and Vladimir. In the decision of the question of constructing the Eastern Don Railway, coal will prevail. In the interest of the fuel supply of the empire,* it would be safest to increase it with coal. Killing the coal on the Volga now, petroleum products themselves will be killed and it is to be hoped that to such a demand for petroleum a limit will be put." The present limited transportation facilities from Baku to the Black Sea make thoughts of petroleum displacing coal for fuel, even for steamers in the Black Sea, impossible. English coal can be bought at Batoum, including duty of 6s. per ton, for 27s. a ton, while a supply of petroleum residuum can only be had by shipping it from Baku in barrels, at a cost of nearly twice the price of coal for freight only. Petroleum residuum, to displace coal in the Mediterranean trade, would have to be delivered at Constantinople and Malta, because if it were even given away at Batoum it would hardly be a sufficient inducement for vessels to spend the six or seven days necessary to run from Constantinople to Batoum for fuel. Taking the present minimum cost of the article at Baku at 2s. 1l. free on board, the rate of freight in bulk from Baku to Batoum, with the expense of pumping into tanks and vessels, at 20s. 7d. a ton —which is also the minimum—admitting railway capacity to be unlimited and the sea freight the same as that charged by steamers to Odessa—a shorter run—11s. 8d. per ton, the actual cost of petroleum residuum at Constantinople will be 35s. 2d. per ton, to which not less than 10 per cent. must be added for profit and and expenses there, and we have 38s. 9d. as a fair selling price, against English coal at 20s. 10d. and 21s. 11d. per ton. As Malta is five or six days farther than Constantinople, and English coal worth about 16s. 8d. or 17s. 9d. a ton there, delivering petroleum residuum there is wholly out of the question. The great and only inducement for shipowners to abandon the use of a known and tried fuel, the supply of which is assured, and to alter their steamers so as to burn a new fuel, the supply of which is exceedingly uncertain, and the expense of which, even under the most favourable circumstances that can at present exist, must be greater than coal, is that a pipe line from Baku to Batoum will soon be constructed, refineries erected on the Black Sea coast, and petroleum residuum will be given away in sufficient quantities to supply the world. The following extracts from the concession for the construction of the pipe line referred to, explain the slowness of capitalists in taking the matter up. All the machinery, materials, and pipes for the line must be manufactured in Russia, and from Russian material. The Government will exercise the most strict control of the line, to see that no one having an interest in it has any other direct or indirect interest in producing, refining, or trading in petroleum products, which is strictly forbidden. The minimum charge for transportation from the wells to the Black Sea is about 1s. 7½d. per barrel of 42 gallons, a distance of 560 miles, against a charge of 1s. 10½d. per barrel in America for 300 miles; the whole of the line is to become the property of the Government at the expiration of seventy-five years. There is also a small Government tax to be paid by the Company owning the line, equal to the present value of the crude oil at the wells. At present there are not more than half-a-dozen small steamers in the Black Sea using petroleum fuel; they run between Russian Black Sea ports, and have been getting their petroleum residuum at Novorossisk, at a cost of about 23s. 10d. per ton. It costs the sellers fully ten times that amount. A small trading vessel, fitted to carry petroleum residuum in bulk from Novorossisk to Odessa, took one cargo to Odessa, which, from the fact that this vessel is now loading at Batoum, and will be more than thirty days getting a cargo of 300 tons, at a cost of probably not less than £2 10s. a ton—sales were made of small quantities at that price, but not for fuel, last month—it is fair to presume that the supply at Novorossisk is either exhausted or that the product was not satisfactory. Another significant fact is that the Russian Steamship Company, the most energetic, enterprising, and best managed corporation of Russia, owning the greatest number of steamers in the Black Sea trade, has never seen fit to change from coal to petroleum fuel. These are indisputable facts, and the inference is only reasonable that if it is dependent upon the supply from Russia, petroleum is indeed a fuel of the very distant future.

Russia—Iron industries of the South.—The Briansk Society's Smelting Works, situate at a distance of four miles from Ekaterinoslav, were opened on the 10th May last. In consequence of the establishment of this new foundry, Russian and foreign capitalists propose to open several other works, in the hope that the home mineral industry may be finally established on a firm footing. Cast iron will be produced from minerals found on the spot, and by the aid of combustibles found in the locality in more than sufficient quantities. At the present time cast iron is produced from foreign combustibles and minerals. The mineral wealth of South Russia is inexhaustible, and the quality is sufficiently good to produce iron and steel equal to the best European. The coal deposits are connected with the iron mines by a railway, and the Catherine Railway is especially adapted for transporting coal and ironware. Coke also is produced in large quantities, the Don basin having for fifteen years supplied the largest works of the interior and those of Moscow. The *Novoe Vremyra* says that the course entered upon will lead to a regular and systematic working of the riches of South Russia, and develope the economic forces of the country.

Switzerland—Utilising the Rhine fall.—An application, backed by large capital, has recently been made for a concession to utilise for the manufacture of aluminium the water power of the largest cataract in Europe, the Falls of the Rhine at Schaffhausen. The applicants, Messrs. J. G. Nehers, Sons, and Co., ironworkers, at Schaffhausen, ask for the privilege of constructing a dam from the Laufen Mill to the railroad bridges, a length sufficient to furnish them with a volume of water amounting to 98 cubic yards per second. They purpose to establish works for the manufacture of aluminium, at first furnishing employment to 500 workmen, and later on to 1000. They estimate the water power requisite to carry on their works at the equivalent of 1500-horse power, and submit with their application the necessary drawings, maps, and plans. A joint stock company, with a capital of £480,000, is prepared to conduct the enterprise, and they offer all reasonable guarantees against any defacement or marring of the natural beauties of the Falls. About twenty-five miles below the point where it issues from the Lake of Constance, the Rhine, with a width of 350ft. and an average depth of 21ft., plunges over a barrier of rocks varying in height from 45ft. on the right bank to about 60ft. on the left. Including the rapids, the total fall within a distance of a little over a third of a mile, is estimated at 150ft. The volume of water passing over the Falls per second varies from a minimum of 151 cubic yards in February to a maximum of 657 cubic yards in July, when in consequence of the melting of the snows in the mountains, and the rise in all the tributary brooks and streams, the Rhine reaches its highest point. From observations carried on between the years 1817 and 1876, a period of sixty years, the Rhine at Schaffhausen reached its lowest depth, 20ft. 7½in., in 1858, and that measurement is taken as the nominal one in determining the volume of water. There is a noticeable variation in the results obtained from calculations based on that measurement. Upon which of these the most dependence may be placed is uncertain, but it will not be much out of the way to say that the lowest volume of water recorded during the last seventy years as passing over the Rhine Fall at Schaffhausen is not less than 91·6 cubic yards per second. The minimum for the last twenty years has been 215·2 cubic yards per second; the maximum for the last thirty-four years has been 657 cubic yards per second. It is upon these results that the application for the use of the water-power is based. Owing to the opposition of the hotel-keepers the cantonal government of Zurich, to whom of right the application is referred, has refused it. The petitioners are making another attempt, alleging that their project involves no injury to the beauty of the Falls, and offering to furnish any reasonable guarantee to that effect. Here the matter at present stands. It is a question of the æsthetic *versus* the practical. The project seems a most advantageous one and feasible one, and the objections against it do not appear well-grounded. The *Neue Züricher Zeitung*, in a article which presents the case in a practical and sensible light, says:—"What we need are new industries which show a prospect of thriving, and of furnishing employment to thousands who must otherwise emigrate. The new cheap process for manufacturing aluminium can only be carried on where enormous water power is available. The auxiliary use of steam would be too expensive, even were the engines stationed over coal magazines. The prosecution of the aluminium industry is, as a first condition, dependent upon great water power, and therefore Switzerland, whose industries in other respects are lacking in favourable conditions and natural advantages over her competitors, possesses in the present instance an advantage of which she should avail herself in due season. Wherever the manufacture of aluminium in large quantities meets with success, there the kindred industries for working it will in all probability settle, for the reason that in such case a still further advantage would ensue, an advantage offered by no other branch of Swiss industry. Our machine industries complain of high freights, for iron is indeed heavy; but in the industries allied with the manufacture of aluminium, the question of freights would assume a minor importance, as aluminium is of such light weight. When a chance is offered us of perhaps twenty thousand men finding work in Switzerland within the next fifteen or twenty years through the introduction of the manufacture of aluminium, we may console ourselves for the loss of a little water from the Falls of the Rhine."

* Russian anthracite coal, which was used upon the Grazi-Tsaritzin Railway, is said to be much inferior for making steam to English coal.

Improvements in Calais Harbour.—The old port of Calais consists of a long, shallow, outer harbour, connected by means of a lock gate with a floating basin, five acres in extent. The new harbour was commenced in 1875, when a law was passed decreeing the demolition of the Calais fortifications, upon the site of which a large portion of the port is built, but very little progress was made until about six years ago. The works of this new harbour comprise a tidal harbour (*avant-port*) 15 acres in extent, with 890 yards of quay wall, of which about 850 are to be applied to the service of the mail and passenger steamers; and it is here that the new passenger station, with custom-house, waiting and refreshment-rooms, &c., is to be erected, the remainder of the quay being reserved for the accommodation of the regular lines of goods steamers. A depth of 30ft. at high water, neap tides, and 13ft. at low water is to be maintained both here and throughout the whole of the entrance channel, which is also being widened from its present narrow limits of 111 to 140 yards. The Channel steamers will thus be able to enter the harbour at all states of wind and tide without the least difficulty. From the outer port two locks, side by side, each 426ft. long, and divided by gates into several shorter sections, lead to a larger basin forming a floating dock the superficial area of which is 27 acres, having a minimum depth of 25ft., and surrounded by nearly 2000 yards of perpendicular quay walls. At the further end of this basin a graving lock, 70ft. by 340ft., has been built, and provision is made for the erection of two others, should they be required. This floating dock communicates with the canal system of the interior of the country, with gates to admit barges from the Canal de Marck, which leads round the outside of the town. A principal feature of the new works is a second and larger sluice basin on the northern side of the harbour, 250 acres in extent, which has been constructed on land mainly reclaimed from the sea. It is connected with the entrance of the harbour by five gates, each 20ft. wide, through which water is admitted whilst the tide is rising. The principal station of the Northern of France Railway is to be transferred from its present position on the north to the opposite, due south, of the town of Calais, where ample space is available for increasing its present confined area, and this new station will be connected with the above-mentioned station in the tidal harbour by lines and rails encircling the town and the new port, running on both sides, first of the canal and then of the floating dock and of the outer tidal harbour, with additional rails upon the quays for movable cranes to run on, worked by hydraulic power; and, again, other lines of rail running through the warehouses which are to be erected alongside of the quays of the floating dock. In the place of the old fortifications a line of earthworks has been built all round the town, following the direction of, and strategically supported by, the canal, and enclosing the populous suburb of St. Pierre, with batteries and some detached forts at distant intervals. The expenditure on these and subsidiary works up to the present time has been about £1,050,000, and it is estimated that a further sum of about £320,000 will be required in order to complete the whole of the works projected. When the loop-line is completed which is now in course of construction for uniting the Calais line to that from Boulogne to Amiens without entering Boulogne, it is believed that the journey from London to Paris, *viâ* Calais, will be performed in less than eight hours.

RAILWAY MATTERS.

An electric tramway is being built between Bilbao and Santurce.

About half-past four o'clock on Tuesday morning a London and North-Western goods train from Rugby, on entering the Great Eastern Station at Peterborough, missed the points and dashed into one of the iron pillars supporting the roof. The pillar was broken, and a portion of the roof, about 60ft. by 40ft., fell, breaking down the telegraph wires and doing other damage in its descent.

A bridge on the Vandalia line over White River, Ind., behaved very creditably under a derailed train. The American *Engineering News* says:—"In some unexplained way a guard-rail became loosened and turned upward, so that it pierced the tender and derailed it with ten loaded cars behind it. Several tension and compression members were badly bent, but the guard-rails restrained the derailed wheels and the bridge managed to hold together."

In recognition of the action of Linfield, the ganger who, passing through the Betchworth tunnel just before the falling in of the roof and narrowly escaping being entombed, promptly ran forward and stopped the Portsmouth express, the directors of the London, Brighton, and South Coast Railway have voted the man an honorarium of £10. It is understood that some months will elapse before the Portsmouth direct line can again be opened for through traffic, as the obstruction is a very serious one, and the landslip will probably involve the necessity of a thorough overhauling of the tunnel.

During July the quantity of coal brought into London by rail and canal was 490,199 tons, against 565,904 tons in the corresponding month of the previous year. The quantities carried by the various companies were:—London and North-Western, 108,559 tons—decrease, 14,305 tons; Great Northern, 72,063 tons—decrease, 29,179 tons; Great Western, 87,406 tons—decrease, 2820 tons; Midland, 154,444 tons—decrease, 21,994 tons; Great Eastern, 78,421 tons—decrease, 6623 tons; other companies, 9301 tons—decrease, 783 tons; South-Eastern, 1870 tons; Grand Junction Canal, 899 tons. The total on the seven months is, however, 4,117,839 tons—an increase of 8264 tons. On the other hand, the quantity of coal brought into the Port of London by sea was 2,578,356, being a decrease of 15,000 tons for the seven months.

Just before the recent terrible catastrophe on the Toledo, and Western Railway, the American *Engineering News* printed an article generally in praise of wood trestles. In another part of the same issue it printed the following:—"It will perhaps hardly need saying that the editorial in the next page on 'Wooden Trestles' was written before the late disaster on the Toledo, Peoria, and Warsaw Railway occurred. Terrible a commentary as that appears to be on the use of wooden structures to a superficial observer, we have not one word to take back or to modify in respect to it. In proportion to their number, accidents from iron structures have been vastly more numerous and more fatal, and the same is true in substance of small masonry structures, whose greater liability to wash-out is a serious matter. The extra heavy strain, the extra heavy load, the time of night, extra dry weather, the smallness of the structure, and the fact that the train was a special, probably interfering with the usual routine of inspection, have combined to make a terrible disaster, as must need be with human appliances at times, but it does not alter the main fact." After this second "terrible commentary," the *Engineering News* will probably recommend good iron or stone.

They are beginning at last to find out in the United States that there is something in the English locomotive. The *Railroad Gazette* says:—"The Hinckley Locomotive Works, of Boston, are building an express locomotive with a single pair of driving wheels. This engine is built to the order of a Boston syndicate, and is intended to run the fast express, the Flying Yankee, on the Boston and Maine. The engine will not be completed until September 1st. It is understood to embody many new features, and considerable interest will be felt in its performance. Any difficulty from slipping can probably be overcome by the use of the sand blast now successfully used on many English roads and undergoing trial on the Chicago, Burlington, and Quincy. The sand being thrown on the rail by a jet of compressed air, cannot be blown off before the wheel reaches it. Experience in England goes to prove that the success of engines with a single pair of drivers depends entirely upon the character of the sand supplied. If dry and delivered fairly on the rail close to the driving wheel tread, no time is lost from slipping, even where the tractive power of the engine is 94 lb. per pound pressure on the pistons." The blast is an improvement, but express single engines manage to get on without it, and without slipping too.

The recent accidents to children on steam tramways at Birmingham, which have this week been added to by the death of an adult on the steam line at Darlaston, our Birmingham correspondent writes, are causing an increased demand to be made by the public for life-saving appliances to be attached to the engines. At present the Public Works Committee of Birmingham, although they have inspected several different apparatus, seem totally unable to made any practical suggestion to the companies. On the lines of the South Staffordshire Steam Tramway Company a life-protector is in use on some of the engines. To this invention, which I have before mentioned, some further reference may be permitted. It is the invention of Mr. Joseph Smith, the chairman of the Birmingham and Central Tramways Company, and consists of an iron guard, shaped to the engine, and carried in a projecting form some 2in. from the permanent way. By means of compression springs, the guard, on coming in contact with an obstacle, closes to the ground, thus preventing the engine mounting the obstacle. A great improvement has recently been made by connecting a lever on the foot-plate of the engine with the protector, thus enabling the driver, on perceiving a child or other obstacle, to apply the lever with his foot, whilst at the same time he can with his hands reverse the engine and apply the brakes. Forcibly compressed to the permanent way by means of this lever, it appears next to impossible for anything to get under the engine.

In a report on the accident that occurred on the 16th May, between Buckpool and Port Gordon stations, on the Great North of Scotland Railway, when the 10.10 a.m. down express ran off the rails, while travelling at a speed of about forty miles an hour, Colonel F. H. Rich says: "This accident, which might have been attended with most serious consequences, was caused by the express leaving the railway at a place where the rails were bent and pushed out of their proper position by the expansion of the metals. This appears to have been caused by the heat of the sun. The permanent way was only about a year old, and as there were sufficient spaces at the rail joints, to allow the rails to expand, I can only attribute the buckling or bending of the rails to the excessive tightness of Ibbotson's patent fish bolts, which prevented the rails from extending between the fish-plates, for which purpose the spaces are left between the rail joints. The railway, adjacent to where the accident happened, was very deficient in ballast. It has been well ballasted since the accident at the place where it occurred. I attribute the accident in some measure to the deficiency of ballast, which allowed the full force of the sun to affect the rails and chairs. There was no ballast to fix and weight the sleepers and prevent them from lifting or slewing. Rail joints may be so tight as to prevent the proper expansion and contraction of the rails, and judging from the evidence and experience on this subject on the Great North of Scotland Railway, I question whether the fish bolts and nuts used on that railway can be considered safe. The company's servants who were in charge of the train acted well, and the Westinghouse brake appears to have done good service in bringing the train quickly to a stand with all the vehicles except the second coach in fairly good consecutive order."

NOTES AND MEMORANDA.

The six healthiest places in England last week were Derby, Norwich, Halifax, Leicester, Nottingham, and London.

The deaths registered in twenty-eight great towns of England and Wales for the week ending August 20th corresponded to an annual rate of 23·3 per 1000 of their aggregate population, which is estimated at 9,245,099 persons in the middle of this year.

Crystals from Leclanché cells have been described by Herr H. Thoms (*Pharm. Zeit.*) Rhombic crystals of the formula $ZnCl_2.2NH_3$ were found. They are insoluble in water, but on boiling, ammonia is evolved. They can be obtained by dissolving freshly precipitated zinc hydroxide in a solution of ammonium chloride and evaporating till the solution commences to crystallise.

In London last week 2465 births and 1713 deaths were registered. Allowance being made for increase of population, the births were 342 below, while the deaths exceeded by 117 the average numbers in the corresponding weeks of the last ten years. The annual death-rate per 1000 from all causes, which had been 21·8 and 23·3 in the two preceding weeks, declined again last week to 21·2.

It is announced in the *Berichte der Deut. Chem. Ges.*, by Dr. Theodor Curtius, that he has succeeded in preparing the long-sought-for hydride of nitrogen, $(NH_2)_2$, amidogen, diamide, or hydrazine, as it is variously termed. This remarkable body, which has hitherto baffled all attempts at isolation, is now shown to be a gas, perfectly stable up to a very high temperature, of a peculiar odour, differing from that of ammonia, exceedingly soluble in water, and of basic properties.

A temperature of 570 deg. will produce a dark blue colour on polished steel, and 590 deg. a pale blue. Oil or grease of any kind will answer for drawing the temper of cutlery. The temper for lancets is obtained at 430 deg. Fah., axes at 500 deg., swords and watch springs at 530 deg., small saws at 570 deg., and large saws at 590 deg. Copper coloured spots are not produced by tempering, but they may be obtained on the polished surface of steel by immersing the article in a solution of sulphate of copper.

A liquid invented by M. Raoul Pictet, for use as a disinfectant, answers well as a freezing mixture for hardening microscopic specimens. Sulphur dioxide and carbon dioxide, having been mixed and cooled, are compressed until they are liquid, and stored in syphons. When liberated, they rapidly evaporate, with great reduction of temperature. By this means mercury may be frozen, and animal or vegetable tissues rendered solid in a few seconds. It is as easily managed and more effective than ether, the odour being the principal objection.

A paper on the calorific conductibility of bismuth in a magnetic field was read at a recent meeting of the Paris Academy of Sciences by M. A. Righi. The considerable increase of electric resistance, and the intense rotation of the equipotential lines—Hall's phenomenon—which occur when bismuth is introduced into the magnetic field, naturally led to the inference that a decrease of calorific conductibility and a rotation of the isothermal lines should take place under the same conditions. The author has now completed an extensive series of experiments, which completely confirm this supposition.

Measurements have lately been made by Messrs. A. von Ettingshausen and W. Nernst, upon the Hall effect manifested in different metals. They have found, *Nature* says, that tellurium far surpasses bismuth in its power, hence they think that the hall effect is connected with the thermo-electric properties of the metals. The effect is least in tin. Taking this as unity, the effects in other metals are relatively as follows: platinum, 6; copper, 13; gold, 28; silver, 21; palladium, 29; cobalt, 115; iron 285; nickel, 605; carbon, 4400; antimony, 4800; bismuth, 252,500; tellurium, 13,250,000. The sign of the effect is positive in the case of cobalt, iron, steel, antimony, and tellurium, also lead, zinc, and cadmium. It is negative in all the others.

It is difficult to find a simple method of soldering cast iron, because cast iron has but a slight affinity for tin solder. The *Scientific American*, quoting *Der Metallarbeiter*, says the soldering can be made much easier by first cleaning the faces of the broken parts from all impurity, which is not necessary when the fracture is of recent occurrence and the broken parts are perfectly clean on their faces. With a brass wire scrubbing brush the faces of the fracture are continually scrubbed until they finally appear perfectly yellow, thus in a certain sense being "dry plated" with brass; the rough cast iron rubs off brass from the fine wires very quickly. The brazed surfaces are tinned just as brass is tinned, and then with no greater difficulty the parts can be soldered together.

The explorers sent out by Gov. Torres report that there is an active volcano fourteen miles south-east of Bavispe, in the Sierra Madre Mountains. An American contemporary says:—"The party could not approach nearer than four miles. The crater is pouring forth an immense volume of smoke, fire, lava, and boiling water. Issuing from the side of the mountain the lava in vast waves is slowly pouring into the canyons, which are being filled up. Boiling water has destroyed all vegetation in the valleys. Boulders weighing tons are hurled down from the crater. The noise is terrific. The party had great difficulty in approaching within four miles of the mountain because of great chasms made by earthquake. All roads and trails are totally wiped out. Not a bird or any living thing could be seen within ten miles of the volcano. The town of Bavispe is a complete ruin. The people are living in tents on the high plains.

The American papers are still hammering at the question of power used in milling. *Power and Transmission* now says:—"It ought to take about 40 horse to make 100 barrels of flour per twenty-four hours. This, if steam is used, will require the evaporation of from 25 lb. to 40 lb. of water per hour per horse power; or from 1000 lb. to 1600 lb. of water per hour; say 24,000 lb. to 38,400 lb. of water for the 100 barrels of flour. This will be from 240 lb. to 384 lb. of water per barrel of flour. The boiler will require from $\frac{1}{8}$ lb. to $\frac{1}{10}$ lb. of coal per lb. of water; so that if the water required is only 240 lb. per barrel of flour, the coal required may range from 24 lb. up to 48 lb. per barrel of flour. If 384 lb. of water are required per barrel of flour, then the coal required may run from 38·4 lb. per barrel, up to 76·8. So you have the extreme of 24 lb. and 76·8 lb. of coal; the maximum being about three times the minimum. The coal will run from 2·50 dols. to 5 dols. per gross ton, which is from 0·1116 to 0·2232 cent per lb.; so we have a further range of cost, of from 24 × 0·1116, equal to 2·68, to 76 8 × 0·2232, equal to 17·141 cents per barrel."

It has been found by Mr. Wright that the electro-motive force—0·538 volt—of zinc-aluminium cells—zinc in zinc sulphate, aluminium in potash alum—is opposite in direction to that calculated from the thermal data—0·938 volt; so also for other aluminium cells. Mr. A. P. Laurie attributes these contradictory results to the well-known property of aluminium in contact with air or water of becoming coated with oxide; and states that the abnormal electro-motive force—measured by an electrometer—is reduced to 0·14 volt on cleaning the aluminium with sand-paper. When the aluminium plate is amalgamated, the electro-motive force becomes normal, and equal to 0·46 volt, and the plate is speedily covered with a growth of oxide. Two aluminium wires, one cleaned the other amalgamated, placed in a solution of aluminium sulphate, give an electro-motive force = 1·08 volts. Wright in reality measured the electro-motive force between aluminium oxide on an aluminium plate and zinc; and the value obtained was probably due to the heat of formation of zinc sulphate − that of aluminium sulphate + that of aluminium oxide − that of water.

MISCELLANEA.

Next May there will be an exhibition of the work of Berlin apprentices in all the principal industries and of the pupils of the various technical and trade schools of Berlin.

The silicium bronze of the Phosphor Bronze Company is now being successfully used for the spokes of "cycle" wheels, one of the objects being to avoid breakage and the effects of the corrosion which attends steel wire spokes.

On the day of the recent visit of the Institution of Mechanical Engineers to the Forth Bridge some exceptionally fine photographic views of the bridge and of the Forth were taken by Mr. Philip Philips, of the Forth Bridge Works, from whom they are obtainable.

The fourth examination of candidates for the offices of Municipal and Local Board Engineers and Surveyors will be held by the Association of Municipal and Sanitary Engineers and Surveyors, at the Town Hall, Manchester, on Friday and Saturday, the 7th and 8th of October next.

It appears that during the construction of the Delagoa Bay Railway some important discoveries have been made as to the capabilities of the country it traverses, and in cutting through a hill a bed of coal was struck, and a tunnel is now being run into the hill in order to expose the seam. The coal is anthracitic.

The recent great fires have directed special attention to the means available for automatic extinction, and Messrs. Mather and Platt, of the Salford Ironworks, have sent us particulars of the most recent arrangements of the Grinnell sensitive automatic fire-extinguisher as fitted by them in large numbers of cotton mills and other business places. The apparatus was partly illustrated by us in our impression of 3rd October, 1884.

A crowded elevator, worked on a building in Mercer-street, New York, fell three stories on the 18th inst. Eighteen women and girls were being lifted to the upper part of the building, where they were employed when the elevator fell. One of the women was killed outright, three were fatally injured, and others were slightly hurt. The cablegram announcing the accident naively says, "the safety appliances were not working."

The *Army and Navy Register* says:—"We understand that Secretary Whitney has fully determined to build the armoured battle ship authorised by Congress in accordance with the plans of the Barrow Shipbuilding Company, for which the 15,000 dols. prize was awarded. Detailed working drawings are now in course of preparation by Mr. Johns, the naval architect employed by this company. The vessel will be built at the New York Navy yard, and orders for the commencement of the work and the necessary preparations at the yard which are required to be made are to be given very soon."

A steam boiler exploded on the river Ouse, near Selby, in Yorkshire, on Monday morning. The boiler was that of a small river steamer belonging to a country carrier named Fenniman, which, as usual on Mondays, carried passengers. The force of the explosion blew young Fenniman into the water and he was drowned. Three passengers were very badly scalded. On the same day, shortly after the commencement of work, an explosion, supposed to be of one of the economisers, took place at the Junction Spinning Company's cotton mill, Middleton Junction, near Oldham. The explosion occurred at the rear of the boilers, four of which were working, and the whole of the roof fell in.

A machine has been designed by Mr. H. S. Maxim for the separation of non-magnetic metals from non-metallic substances, the separation being effected by allowing the mixture to fall between the poles of rapidly revolving magnets, the polarity of which is subject to continual reversals. The metals move in the direction of rotation of the magnets, and can be collected in a suitable chute, while the non-metallic substances fall straight down between the poles. This apparatus can also, the specification says, be used for assaying, by weighing ores in an ordinary balance and also when suspended between the magnet poles. The quantity of salts, saccharine matter, or acids in a solution can be ascertained by the same machine. Sand and other non-magnetic and non-metallic substances may be separated from non-magnetic metals.

Retained in perfect running order in the United States Steamboat Inspector's office at Louisville, Ky., says the Louisville *Courier Journal*, is an oscillating engine constructed in 1809 by Daniel French. It is only of model size, and is probably the first engine of the kind ever constructed. Its description is simple. Having its piston-rod attached directly to the crank pin, as the crank revolves, the cylinder oscillates upon trunnions, one on each side of it, through which the steam enters and leaves the steam chest. The valves are within a steam chest, oscillating with the cylinder. It is, perhaps, as satisfactory an engine of this class as has ever been built, for it is well known that the mechanism actuating the valves in oscillating steam engines has seldom proved perfectly satisfactory in its operation.

A vessel has just been launched at the Imperial dock-yard at Wilhelmshaven which marks a new departure in German naval architecture. It is the cruiser Swallow, whose dimensions are: Length, 62 m.; breadth, 9·36 m.; and depth, 5·60 m.; the tonnage being 1300 tons. The Swallow is a composite ship, with twin engines of 1500-horse power driving two screws, which give a speed of 13½ knots. The vessel is armed with eight long 10½ cm. Krupp guns, four firing in the direction of the keel, and the rest being revolving cannon. The crew numbers 120. The vessel is not, of course, intended to take its place side by side with armoured vessels in the contingency of a naval war, but will be employed on foreign service, especially in cruising about the coast of African colonies. Hardly ten months intervened between the laying of the keel and the launch of the ship.

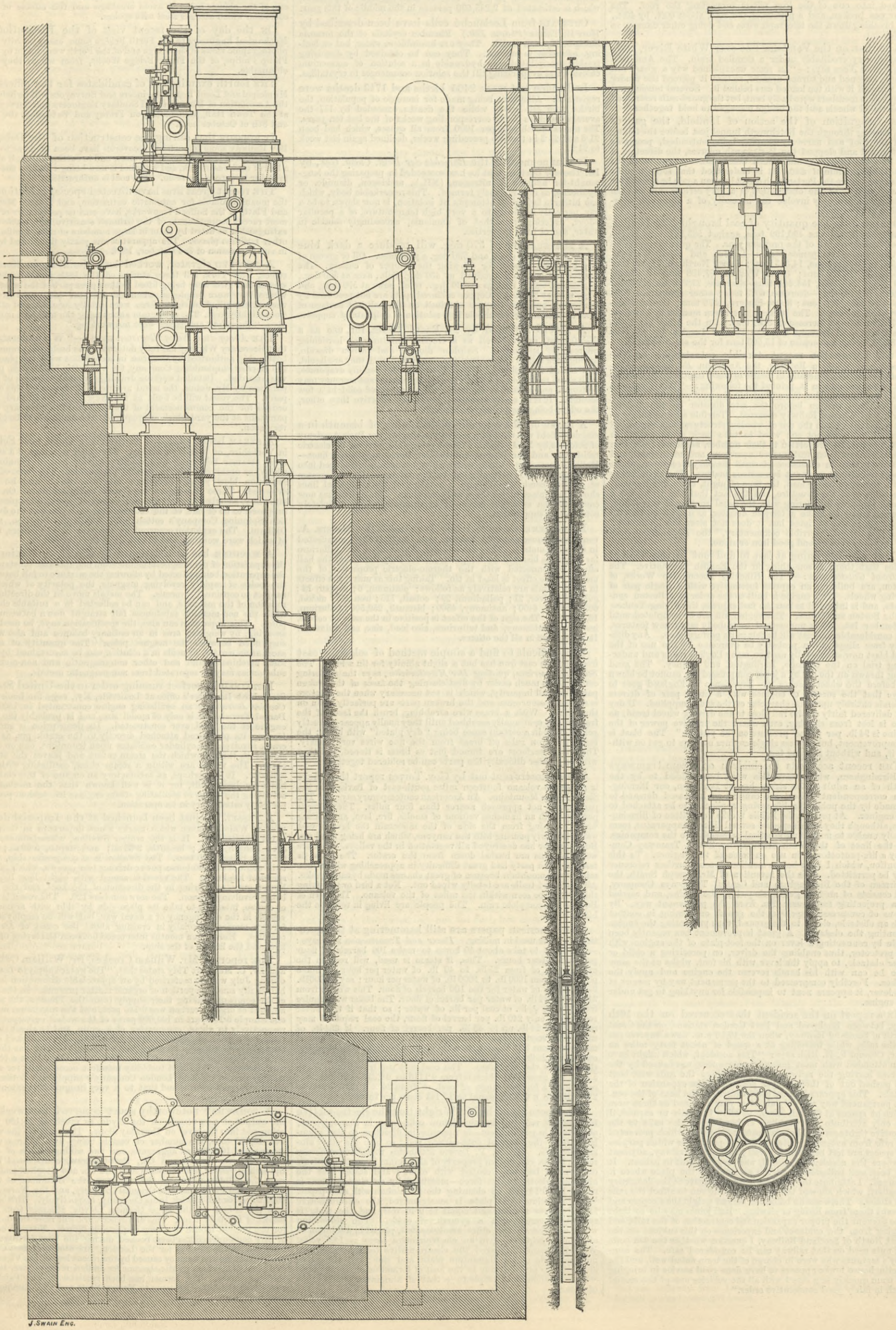
The report of Mr. William Crookes, Dr. William Odling, and Dr. C. Meymott Tidy states that, "The water supply to London during July was characterised by an appreciable diminution in the habitually small proportion of organic matter present. In the case of the companies taking their supply from the Thames, the mean amount of organic carbon was 0·146 part, and the maximum in any one sample 0·169 part in 100,000 parts of the water, corresponding respectively to about one-quarter of a grain, and to about three-tenths of a grain of organic matter per gallon. More marked even than the diminution in its proportion of organic matter was the increased degree of freedom of the water from other than a bluish tint of colour. The slight turbidity manifest occasionally for some months past in the East London Company's supply was noticeable during the past month, and that to a very insignificant extent, in two samples only."

A somewhat noteworthy spurt occurred last week in the output of new vessels on the Clyde, as much as 15,180 tons being put into the river on Thursday alone. The total for the week was 15,280 tons, the number of vessels being five. Three were steamers of 10,700 tons aggregate, and two sailing vessels of 4580 tons. Messrs. Russell and Co., Port-Glasgow, contributed both the sailing vessels, and Messrs. Caird and Co. and Stephen and Co. were the builders of two of the steamers—the Britannia, of 6600 tons, for the Peninsular and Oriental Company, and the Warora, of 4000 tons, for the British India Company, respectively. This week sees the launch of the large German Lloyds' steamer from the stocks of Fairfield Yard. This and other work will raise the output for the present month to a very respectable figure. No fresh order of any consequence has been booked during the past fortnight, a 1000 ton paddle steamer for the London, Brighton and East Coast Railway, to fill the vacancy caused by the recent loss of the Victoria, and a small 600 tons paddle-steamer for Indian river service, being the only items. The former has been received by the Fairfield Company, the latter has gone to Messrs. Scott and Co., Greenock.

WIDNES WATERWORKS.—NEW PUMPING MACHINERY.

MR. HENRY DAVEY, M.I.C.E., ENGINEER.

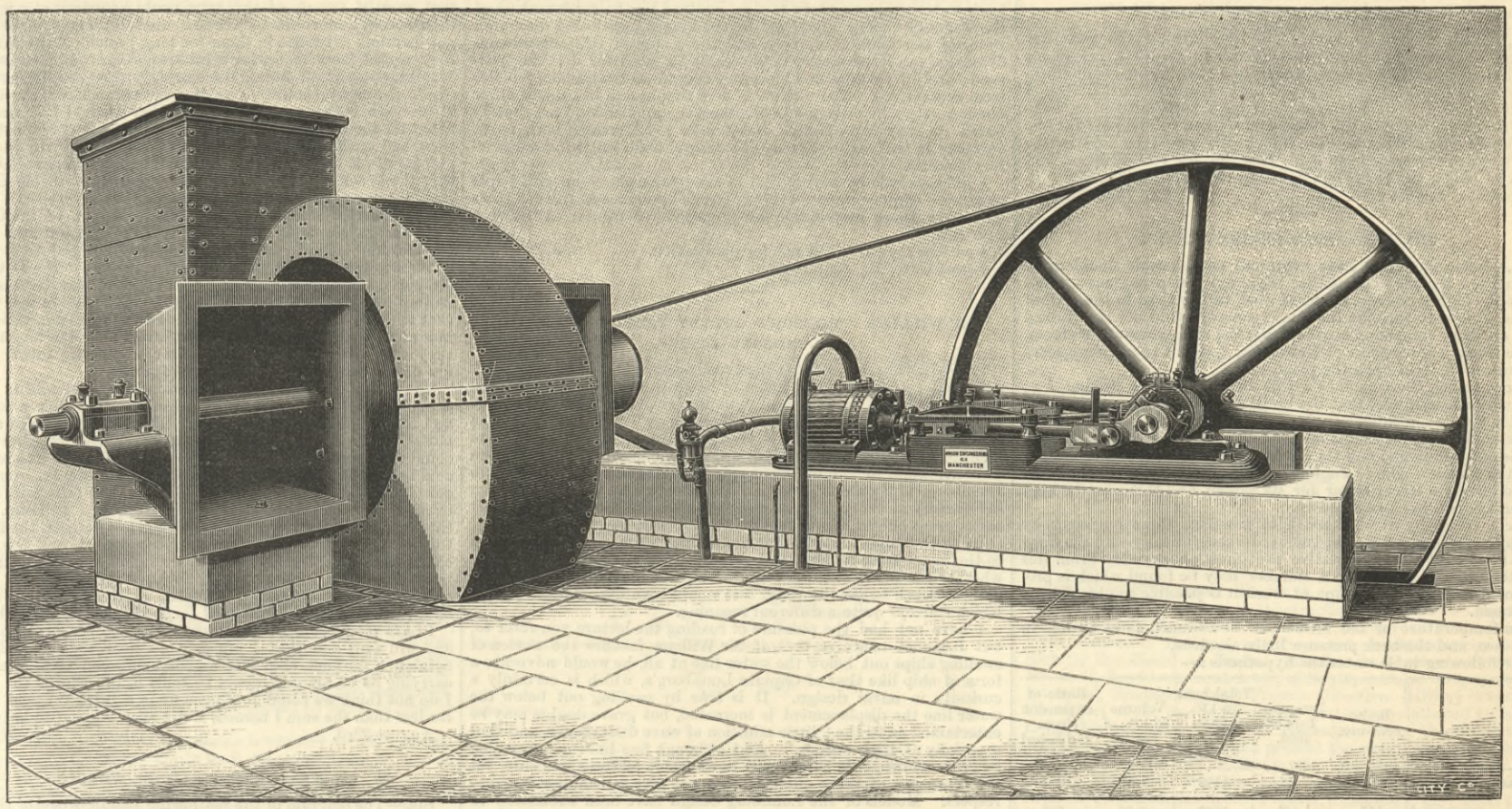
(*For description see page* 171.)



J. SWAIN ENG.

LARGE SCHIELE VENTILATING FAN, MANCHESTER EXHIBITION.

THE UNION ENGINEERING COMPANY, MANCHESTER, ENGINEERS.

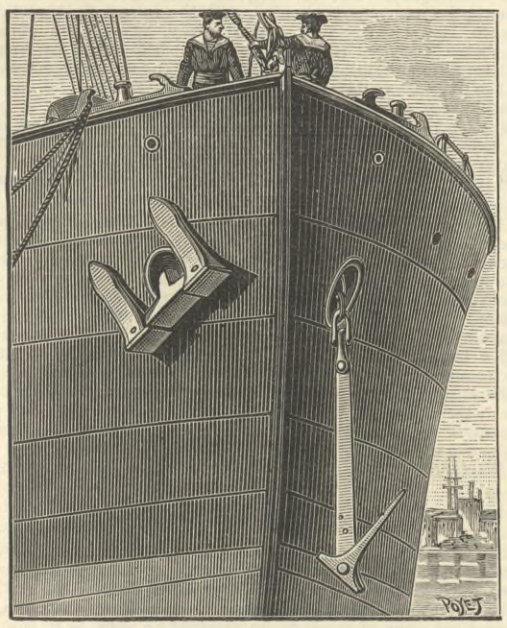


SCHIELE FAN.

The accompanying engraving illustrates a large Schiele fan, which is employed to ventilate the machinery hall at the Manchester Exhibition, by discharging hot air through the roof. The fan is 5ft. in diameter, and is exhausting about 80,000 cubic feet of air per minute. A very similar fan, 7ft. in diameter, is employed in ventilating the model coal mine at the Newcastle Exhibition.

WASTENEYS SMITH'S "STOCKLESS" ANCHOR.

Mr. Wasteneys Smith, of Sandhill, Newcastle-on-Tyne, exhibits at Newcastle his patent "stockless" anchors, and models of vessels fitted with same. Smith's anchors are now so well known that a detailed description is unnecessary. They have been adopted by the leading shipping companies throughout the world, besides the British and many foreign Governments, upwards of 1000 anchors having been made, including some over 6 tons weight. Mr. Smith has recently patented a modification of his yacht anchor. This consists in constructing the anchor in only two pieces—the arms and crosshead being in one and the shank pivotted through it—the whole forming a very compact and serviceable anchor, with an entire immunity from fouling; different sizes of this new yacht pattern are shown. A model to scale of a 6¼ tons Smith's and an ordinary anchor, Admiralty pattern, of same weight, are shown side by side for comparison, a glance at which will readily show the many advantages possessed by the former. A model of the bows of H.M.S. Agamemnon to ½in. scale is also shown fitted with a 5 tons patent stockless anchor, as well as a model of the bows of a merchant vessel built by Messrs. Joseph L. Thompson and Sons, Sunderland, having these anchors arranged to stow, drawn partly up ordinary sized hawse pipes, as illustrated above. By this simple method all "catting and fishing" gear can be dispensed with. Many ship models in the Exhibition show this arrangement applied. Our engraving is taken from a photograph of the s.s. Emilie, and shows the anchor towed up the hawse pipe.



BOWS OF S.S. EMILIE.

Lieutenant Zalinski's dynamite gun, at Fort Lafayette, is now nearly ready for a practical test. The Secretary of the Navy has ordered a boat to be turned over to him, and in about three weeks he will try to blow it up from a distance of 1½ miles.

PORTABLE BALING-PRESS.

Messrs. Collit and Co. are the successors of Messrs. Tuxford in the Skirbeck Works, Boston, Lincolnshire. Messrs. Collit exhibited at Newcastle the neat combined engine and baling-press, which we illustrate. It will be seen that a small vertical engine and boiler are mounted at one end of a truck, while the press stands at the other end. The press is of very simple construction, made of stout timbers; one side of the box comes out altogether, in order that the bales may be discharged. The machine has been specially designed for use by English farmers sending hay by rail to London. They have to pay so much for a truck, no matter what it contains; by the aid of the press the weight of trussed hay that can be sent by a truck is very greatly augmented, and thus a great saving in railway charges is effected. The machine is made portable, so that it may be sent from farm to farm.

PUMPS—WIDNES WATERWORKS.

On page 170 we illustrate a set of pumps recently erected at Stocks Well for the Widnes Local Board by Messrs. Hathorn, Davey, and Co., of Leeds. Some time ago the question arose of increasing the supply of water from Stocks Well, and several plans were proposed. In the end, the Board instructed Mr. Henry Davey to report. He recommended putting pumps into the bore hole—which at that time fed the well shown on our engraving—and at the same time to put in a new plunger pump in the place of the existing bucket and plunger. The problem presented considerable difficulties. The lining of the well was not to be depended on to support the new pumps, and the small amount of room available in the well increased the difficulty. The manner in which Mr. Davey has overcome the difficulties makes this an interesting example of pumping plant. The engine, well, and bore-hole existed, and the new pumps had to be made to fit the place.

A circular cistern, as large as the well would take, was erected on the old girders in the well; that cistern was made strong enough to support the pumps, and was suspended by means of five tie-rods from a strong cast iron curbing firmly imbedded in a block of concrete made to extend around the top of the well, clearly shown in our engravings. On the bottom of the cistern was erected the plunger pump 24in. diameter by 8ft. stroke. The space available was not sufficient for single valves of sufficient area. That difficulty was overcome by adopting two sets of valves in the positions shown. The bore-hole was not large enough to admit a single-acting pump of sufficient capacity to feed the 24in. plunger. A double-acting pump was a necessity, but the difficulty arose of applying the proper motion to such a pump. That was accomplished by providing the top bucket with two rods attached to the top of the plunger of the well-pump, and communicating the reverse motion to the bottom bucket by means of the peculiar beam motion used by Mr. Davey in his inverted compound engines. We gave particulars of this motion in connection with our illustration of the Luton Waterworks engine some time ago. The new pump-work was got in without disturbing the old engine. The engine itself was improved by the removal of the old Cornish and the substitution of the differential gear, The water supply has been doubled. The yield before the alterations were made was equal to the capacity represented by four strokes per minute of the engine; it is now equal to that of eight strokes. The engine now pumps about 50 per cent. more water with the same consumption of fuel. The Bull engine has a cylinder 67½in. diameter and 8ft. stroke. The ram pump is 24in. diameter and 8ft. stroke; and the double-acting bore hole pumps are 17½in. diameter and 8ft. stroke. The work has been directed by the Board's engineer, Mr. Carr.

Exhibition of Artificial Illumination and of the Naphtha Industry at St. Petersburg.—The Russian Imperial Polytechnic Society proposes to hold this autumn an exhibition of appliances and materials for artificial illumination and of objects relating to the naphtha industry. The society is desirous of co-operation from abroad, and every facility will be given to foreign exhibitors, such as exemption from Custom-house duty and patent rights for their exhibits. The programme of the exhibition includes (*a*) historical collections illustrating the progress of artificial illumination from the earliest times; (*b*) lighting by means of solid or liquid illuminants, either vegetable or animal; (*c*) gaseous illuminants and apparatus for their production and application; (*d*) electric lighting; (*e*) various sources of light and special appliances for the same; (*f*) lamps for burning mineral oils; (*g*) photometry; (*h*) naphtha and its products, appliances used in the extraction, storage, and transport of naphtha and the manufacture of its products; (*i*) heating by means of petroleum or its products: (*j*) lubrication—mineral—oils. The exhibition will open in November, and the admission of objects will take place between August 27th and October 27th. Besides medals and diplomas, the following prizes in money will be given:—(1) 1200 roubles for the best type of lamp of simple and cheap construction, for use in peasants' cottages, and capable of burning heavy mineral oil; (2) 1000 roubles for a similar lamp of rather higher price; (3) 500 roubles for a house stove, burning naphtha refuse; (4) 500 roubles for a galvanic battery for lighting incandescent lamps; (5) 1000 roubles for a day and night signalling apparatus; (6) 500 roubles for phosphorescent substances. All the prizes will be open to foreign competitors. Any further particulars may be obtained from Mr. G. Kamensky, 21, Blomfield-road Maida-hill, London.

LETTERS TO THE EDITOR.

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

TELEGRAPHY AND LIGHTSHIPS.

Sir,—With a view of saving life here during the next few months, when wrecks occur at times three in an hour, permit me to call for tenders to erect and maintain a telegraphic communication between the three lightships and the Coastguard station here. I should require the wire buoyed near each ship, with a separate wire from such buoys to the ships; and a prize will be paid for the best design submitted me. The line really would be laid in the same track as the submarine cable now lies, in two divisions, and with two buoys, to the nearest lightship to repair same easily.

Ramsgate, August 20th. T. Bradshaw.

THE NEWCASTLE ENGINE TRIALS.

Sir,—Some engineers have expressed considerable doubt as to whether the economy claimed for triple expansion engines was not due to the higher pressure of steam used, rather than to the style of engine, and as to whether the same economy could not be attained in an ordinary compound engine using the same pressure of steam.

The recent engine trials at Newcastle, it seems to me, may serve to throw some light upon the point.

In comparing these engines I will assume that the stoking, &c., is equally efficient, and that the brake horse-power bears the same relation to the indicated horse-power in each case.

The engines most suitable for my purpose seem to be the Paxman simple and compound and the Foden compound. It will be noticed that the Paxman simple engine has an advantage over the other two in having a larger boiler for its power, and this must be kept in mind in making a comparison.

The method by which I mean to compare these engines is by finding the amount of steam generated—theoretically—for the same amount of heat at the respective pressures employed. From this and the ratio of expansion a number may be found which is proportional to the total amount of work it is possible to obtain from the steam.

The temperature of the feed-water is assumed to be 62 deg. in each case, and the back pressure 16 lb. absolute.

The following table states the hypothesis :—

	Boiler pressure.	Temperature of feed.	Total heat in 1 lb. steam above 62 deg.	Volume of 1 lb. of steam.	Ratio of expansion (from published cards).
Paxman, simple ..	95	62°	1153	3·97	4·4
,, compound	150	62°	1163	2·71	7·7
Foden, compound..	250	62°	1175	1·73	9·5

And from this is deduced the following:—

	Pounds of steam generated by same amount of heat.	α	β	Comparative theoretical consumption per B.H.P.
Paxman, simple.. ..	3·97	1084	805	2·528
,, compound..	2·686	1348	1017	2·001
Foden, compound ..	1·697	1462	1204	1·690

$\alpha = C \times P (1 + \log. E)$.
$\beta = C \times P (1 + \log. E) - 16\,C\,E$.

Where C = Cubic feet of steam in second table.
P = Absolute boiler pressure.
E = Ratio of expansion.

It will be seen that I have taken the consumption of the Paxman simple engine as a standard, and from it have found the consumption in the last column. These figures, when compared with the actual consumption on trial, are, I think, pretty convincing. If the Paxman compound were only as efficient in using its steam as the Paxman simple, its consumption would have been 2·001—it was 1·804. That of the Foden compound, on the same assumption, would have been 1·69—it was 1·858; but if the fault shown in the indicator cards had been remedied it would probably have been 1·7. Still, this is not nearly so good a result for the steam as in the Paxman compound. In conjunction with these results it will be seen that the range of temperature in the cylinders is least in the Paxman compound, and greatest in the Foden compound. These two facts bear, to my mind, the relation of cause to effect, and seem to point out that for pressures such as 250 lb. to be used economically, it is necessary that we should have a triple expansion engine, if not a quadruple expansion one.

	Range of pressure.		Range of temperature.	
	H.P.	L.P.	H.P.	L.P.
Paxman, simple.. ..	91·5—118	—	113°	—
,, compound..	118	38	95°	70°
Foden, compound ..	211	27	147°	56°

Hartlepool, August 23rd. E. Hall-Brown.

THE STRESSES IN THE IOWA BRIDGE.

Sir,—With reference to Mr. Robert H. Graham's remarks on this subject in your issue of the 19th inst., permit me to say that I was not aware that "arch" is a dignified name, and that I used it because I thought it was the right name for a structure which has no lower tie, and therefore causes horizontal thrusts on its abutments. The truss used for the Cleremont bridge is an "arch" in this sense of the word.

The Cleremont truss has no affinity to the whipple type, but it may be said to be "nothing more than a Warren truss, with a slight twist and a few internal modifications." The principal modifications are:—(1) The omission of the bottom chord in the middle panel, thus causing horizontal thrusts on the abutments; and (2) the introduction of a hinge joint in the middle of the top boom.

The half-load at the key was not omitted in calculating the horizontal reactions of the dead load, and on working them out again the figures given in the paper appear to me to be correct.

J. H. Cunningham.

1, Victoria Mansions, S.W., August 22nd.

THE MANAGEMENT OF MARINE BOILERS.

Sir,—Your able article on the management of marine boilers in last week's issue contains many facts of value to those who have the charge of machinery, and is deserving of their most careful consideration.

As a sea-going engineer of some years' varied experience, I can endorse the great importance of two points, viz.:—(1) The use of zinc, and (2) the absolute need for a fresh water supplementary feed, increasing pressures rendering the latter a *sine quâ non*.

Your hint to engineers to use an auxiliary boiler for this purpose is very good; but I would suggest carrying the same pressure on it as on the main boilers, and using the steam in the engines—thus getting some useful work out of it—and afterwards condensing it, in place of condensing it with no result to show for the fuel expended except the fresh water obtained.

The donkey boiler could always be used for this purpose if constructed of the required scantling.

But I have to draw your attention to another and much better method of obtaining the same result, viz., by the use of a machine termed a "double distiller," from which the requisite supply of fresh water supplementary feed is obtained by the condensation of the steam or vapour given off by the heated circulating discharge water of the main condenser, and the water of this second condensation can if necessary or desirable be used for drinking purposes, and by this method no injury accrues to the auxiliary boiler from deposit, &c. The method is very simple, and like many other distinct steps in advance in engineering appliances, has already found its way into H.M.'s Navy with good results, both as to economy in fuel and obtaining the desired fresh water in a satisfactory manner.

I will conclude by saying that in my opinion steamers with triple expansion engines must have some such appliance as this for their boilers, or those responsible be prepared for trouble in the very near future.

I enclose my card, but not for publication. J. W. R.

Forest Gate, E., August 22nd.

SIR WILLIAM THOMSON'S RECENT LECTURE AND THE LUNDBORG DESIGN.

Sir,—In your last issue, attention is drawn to a lecture recently delivered by Sir William Thomson, in which the lecturer is stated to have favoured the notion of "swelling ships out below the waterline instead of giving them vertical lines." After stating the advantages to be gained by the adoption of such a form, you mention that this is an old suggestion, and immediately after you draw attention to "an excellent ship design of this kind by Captain Lundborg, of Sweden." You further remark that this design "was satisfactory in every respect, as it secured fine lines fore and aft and a great height of metacentre above centre of gravity."

In another report, I read that Sir William Thomson drew attention to the fact "that it depended very much on the build of the ship whether the waves it caused would be great or small, and that the greater depth below the water line would give the greater speed," which conveys quite a different meaning.

I have not had the pleasure of reading the lecture you refer to, but I cannot conceive that, if Sir William favours the notion of swelling ships out below the water line at all, he would advocate a form of ship like that of Captain Lundborg's, which is certainly a curiosity in naval design. It is true by swelling out below the water line the displacement is increased, but grave doubts may be entertained as to the "little addition of wave disturbance, and that especially at high speeds." And although fine lines accompanied by great metacentric height may be desirable features in a ship, yet the possession of these qualities may not give satisfaction in every respect. Models of the Lundborg design have been submitted to experiment, for speed and resistance, and in comparison with other models of some Atlantic liners, their results were very unfavourable and were by no means satisfactory. Captain Lundborg "certainly was not able to do much in this country with his design," and I am inclined to think, if the advantages to be gained by the adoption of such a form for ships were very apparent, he would have had no reason to cross the Atlantic, where his success has been little better than here.

There are many serious practical disadvantages that would be likely to occur in building such a form, leaving out the question of economy altogether. Among others would be difficulties in frame bending, plating and rivetting, at the under water shelf, and the strengthening of the same aft, to resist vibration of screws. And as I have before stated, the form has been found unsuitable for economical high speed propulsion, which in itself defeats the purpose of the original design. E. H. Parker.

Leven Ship Yard, Dumbarton, August 17th.

THE CLARK PROCESS.

Sir,—With reference to the various letters in your issue of the 12th inst., we beg to state in answer to your correspondents, Messrs. Gimson and Co., that we are pleased to say we have found the Howatson water softener and purifier thoroughly efficient for treatment of water for domestic use, several machines having been supplied for this purpose with highly satisfactory results.

As regards the question propounded by Mr. J. W. Kennard, we can only say that up to the present we have found it possible to deal with all waters that have been submitted to us. We may mention that one of our first experiments in this direction was the temporary erection of an apparatus at a part of the River Thames where the matter in suspension was excessive, and that we received the following report from Mr. Dyer, F.C.S., Public Analyst, Professor of Agricultural Science in the City of London College, &c.:—"The untreated water was thick and turbid, being loaded with mud, of which it contained in suspension 100·3 grains per gallon, of which 13·1 grains were organic matter and 82·7 grains mineral matter. The treated water was particularly clear, containing less than one-fifth of a grain per gallon of suspended matter." He also states that thirteen degrees of hardness were removed at the same time. Your readers may not be aware that water containing an excess of chloride of sodium may be safely trusted to be used if the other salts be arrested before entering the boiler, thus preventing their combination, and consequent production of scale. It is well known to those who have attempted to make the boiler itself the means of treatment by the aid of various compositions that they are most prejudicial and unsatisfactory, and it will be found that the boiler associations recommend these should not be used, and it may be accepted as conclusive that they have not done this without a careful study of the question, and it is within our knowledge that certain firms who manufacture the materials used for this purpose only avail themselves of their use in conjunction with a machine suitable for the treatment of water prior to its entry into the boiler.

115, Leadenhall-street, E.C., J. W. Gray and Son.
August 17th.

MONITORS AND TURRET SHIPS.

Sir,—I must be pardoned for thinking that in rushing into the indiscriminate defence of the Ericsson monitor, your correspondent "U. S. N." displays a little of the rashness with which he charges me. I confined myself to disputing a proposition which I am glad to find I was mistaken in understanding you, Sir, to have laid down, viz., that above water this type of vessel was the form best adapted for fighting with guns. In doing this, I was expressing the opinion of naval authorities all the world over—America not excepted, so far as it is evidenced by recent construction. In Europe there has not been built, so far as I know, a single vessel of this type for the last twenty years. Our own Navy has never contained one. In the United States five were, I believe, launched some four years ago. Rear-Admiral Simpson says, "There has been much contention about the completion of these vessels," and it appears that, were it not for the large sums already spent on them, their construction would be finally abandoned. They have been superseded, both for coast defence and sea-going purposes, by high freeboard types with the objectionable but inevitable "top hamper." The explanation of this, of course, is that while monitors were never ships, they have ceased at the present day to be even efficient fighting machines. Guns cannot be fought to advantage in a seaway unless they are carried high. Waves are constantly interposing between the monitor's guns and the object aimed at, even if they do not sweep over the deck and flood the turret. On the other hand, as against guns mounted on a high platform, the monitor uses its principal advantage, that of invisibility.

I will not insult your correspondent's understanding by explaining the difference between the target offered by a deck 2ft. above the water to a gun 4ft. higher, and the same deck as presented to a gun 30ft. higher. The Sicilia's deck is, however, under water, except along the middle line, and can only be reached through a great thickness of water or of coal. It is true that her lofty hull offers a large target, but no vital point is exposed, while the monitor could not be pierced anywhere at a point that is not vital. As to seaworthiness and habitability, it seems tolerably obvious that, even if vessels of this type could be driven at a moderately high speed, and could be trusted alone at sea, their crews could not maintain existence in them for long periods, battened down, as they would have to be, for weeks together. It is true that the Miantonomoh accomplished the *tour de force* of crossing the Atlantic under a watchful convoy, and the Monadnock went round Cape Horn, with waterproof coats round her turrets and deck-houses fitted for the occasion, in which condition she could not use her guns, and could have been run down with impunity by the smallest gun-boat. It is also true that the monitor foundered at sea, and that the Weehawken was sunk at her anchors inside Charleston Bar by a wave passing over an open hatch.

As to ventilation, the new Miantonomoh—one of the five recent monitors before alluded to—has a freeboard of 2ft. 6in.; her turrets, funnel, and ventilating tube are armoured to a height of 9ft. above the deck, or 11ft. 6in. above the sea. The Devastation's armoured breastwork enclosing the bases of her turrets, funnels, and up-takes, rises to an equal height. It seems to me, therefore, that with all her "top hamper" shot away the Devastation is still in a much better position as to ventilation than the monitor. I am very sure, however, that the monitor would not throw away the fire of her heavy guns on cowls and funnels.

The truth is, Sir, that to represent these vessels as sea-going warships adapted to present requirements is unfair alike to them and their distinguished inventor. They were designed as floating batteries for service in shallow waters, where deep-draught ships could not operate, and for the attack of low-lying forts, where they could choose their own distance and point of attack. Under these conditions they did good service, though their advocates are apt to overlook the weakness of the forces opposed to them. Even in this capacity, however, they had two grave defects, the first being the faulty construction of the Ericsson turret, and the other the extreme suddenness with which, owing to their small reserve of buoyancy, they sank on being injured below water. The first objection is, of course, not inherent in the type; the second is, and, in the present condition of torpedo warfare, would be fatal.

I have trespassed, I fear, already, Sir, too far upon your space, and will only add that I am glad to hear that in "U. S. N.'s" opinion a 14-knot ship with a 24in. armoured citadel and turret, carrying an 80-ton gun, could be built in the States for £200,000. I do not think we could produce one in a British Royal Dockyard for less than the sum I named, but I shall be glad to be corrected.

August 23rd. G. W. Cobb.

FEATHERING PADDLE-WHEELS.

Sir,—The diagram of the feathering paddle-wheel of the steamer Duchess of Edinburgh, shown on page 154 of your number for the 19th August, is drawn according to the rule usually given, namely, that the planes of the lowest floats should pass at any instant through the centre of the float which is in the highest position. By this means a float leaves the water edgeways, and imitates, in fact, the action of feathering an oar. But I wish to point out that a float on this plan does not enter the water edgeways, and that consequently there is a loss of power in this arrangement. Properly, the entering float should be inclined to the water slightly on the other side of the vertical to what is shown in the diagram, so that practically the entering and leaving floats should appear parallel, or nearly so.

A slight reflection will show that while as at present the plane of the leaving float should pass through the highest point of the pitch circle of the floats, and therefore that the tail rod—or whatever it is called—of the float should point through the lowest point of the pitch circle in order that a float should leave the paddle wheel race edgeways, on the other hand, for a float to enter the water edgeways, the tail rod of the float should point through the lowest point of the apparent rolling circle, as Rankine calls it, the circle which would engage in a horizontal rack at a certain elevation above the water, to propel the vessel at the same speed. The entering and leaving floats should consequently be very nearly parallel, and the lowest float vertical; to secure this arrangement mechanically, some plan similar to Buchanan's original feathering paddle-wheel would be necessary, but set with a certain amount of lead. The arrangement as shown in the diagram imitates very closely the action of the oar, where the blade on entering the water is inclined slightly in the opposite direction to that on feathering in leaving the water; but it must be remembered that the blade of an oar just before catching the water is being carried forwards relatively to the surface, while in the paddle-wheel the float on entering is moving backwards, with velocity relatively to the water equal to the slip velocity.

Mr. Stroudley's curved floats of a paddle-wheel probably owe their success to a great extent to giving the proper direction to the entering edge of the float, but it would be instructive to watch the practical effect of a slight modification of the wheels of the Duchess of Edinburgh required to carry out the ideas of this letter. This could easily be managed with the present arrangement by giving a certain amount of lead to the excentrics which drive the feathering rods. On the other hand, however, it must be remembered that the alteration would tend to exaggerate the difference of action experienced on going astern, so that it would be better to have the plan tried on one of the new paddle steamers doing the Channel passage, and I hope you will use your influence to have the theory of this letter properly tested.

Woolwich, August 24th. A. G. Greenhill.

COMPETITION IN THE HOME TRADE.

Sir,—Makers of machinery when talking about the state of trade at the present time are often heard to give expression to such words as these:—"Competition is now so keen we find a difficulty to get orders at fairly remunerative prices;" or again, "We cannot get a run of work to go straight on with, as in past times, when we could make to stock."

It must be acknowledged these are serious facts for engineers and manufacturers to deal with; and, so far as one can judge of the future, unlikely to become better. Their effect upon the general working of an establishment is to largely increase the expenses for travellers moving about, in the desire to be first in the field for an order; and if he be fortunate to get it, though his firm make a standard type which has taken years to perfect, and upon which much money may have been spent to get to its present state of efficiency, yet it is very often the desire of the customer to have something special, and one cannot blame him, for competition is pressing equally hard in the direction of goods made by his machinery, and for which a market must be found.

It is these constant alterations which often prove such a hindrance in the expeditious output of work, and in necessitating a big drawing-office staff, with alterations to pattern, &c. There is no doubt many orders are taken by large firms in dull times which they would gladly let pass to smaller competitors when they were well stocked with orders.

Anyone who has had much experience in the shops of large or small works will know the great advantage the larger works possess for the production of work, having the command of an experienced staff and good tools for dispensing with unnecessary labour, whereas in the smaller works there is often only one foreman, who has to resort to his own ingenuity to produce some makeshift method of doing the work. The charges upon machinery standing idle are a direct loss to the large firms; whilst, on the other hand the little firm is obliged to spend more time and money to produce the same results.

It would appear to an ordinary observer that there is a decided tendency for many of the little firms to try and make some machine

or parts of machinery—generally a copy from a larger maker—and get it into the market, leaving other work, such as repairing and general local work, for another to undertake, thus placing themselves between two fires, and where there is but a small capital employed they are often obliged to sell at very low figures. The consumer getting machinery indifferently made, and without any finish, which will soon require a good overhaul, and will never be a satisfactory job.

One would not wish to see a healthy spirit of enterprise checked amongst those engaged in any handicraft, but rather have more of it, in the desire to do thoroughly and well what is undertaken.

If, then, the small scattered orders are to be worth the doing to larger firms, it would appear necessary for them so to adapt the systems under which so much routine work has been successfully accomplished; but which are often too elaborate for things on a small scale, and produce friction amongst the heads of departments which is not easily seen by those having the general oversight. That there always will be difficulties and troubles to be got over in the shops is a certainty; but for those who are anxious that the work should continue to gather round the old centres it is well to remember how much unity of purpose and a general desire for excellence will do when it permeates the whole place. This often seems to be more easily attained where the number employed are less, and perhaps this may account in some measure for the apparent success attending their efforts. X. M.

August 22nd.

THE THEORY OF THE STEAM ENGINE.

Sir,—In all text-books and treatises on the steam engine it is stated that steam is condensed in the cylinder by the performance of work; the heat of the steam being converted into work. Now, *à priori*, this seems to be a consistent and rational statement; but I submit that it ought not to be accepted as true until its truth has been demonstrated by experiment. I now write to ask your readers if they can refer me to any experiment made with a steam engine which demonstrates the truth of the proposition. I know of none, and I think it would be impossible to make an experiment of the kind.

Now I venture to assert that steam is not condensed in the performance of work, and that it is impossible it could be so condensed and remain as water under the condition of temperature and pressure obtaining. But I do think that owing to the conversion of heat into work there is a loss of volume in the steam. If the steam were superheated, then it is admitted that no condensation would take place, the loss all falling on the superheat. This again is pure theory, and is not supported by facts, at least to my knowledge.

The whole theory of the steam engine is vitiated by the circumstance that we continuously apply to it laws which apply only to permanent gases, making allowances for its condition of saturation and non-permanent character, which are quite abitrary, and must be so until they are based on direct experiment.

Old notions concerning steam are giving place, in many respects, to new and sounder ideas; but much still remains to be done. Every practical engineer knows that there are puzzles to be met with every day which are quite inexplicable on any recorded theory; such, for example, as the enormous condensation in the small cylinder of triple expansion engines, and the remarkable effect which a condenser has on the gap between the indicator diagrams from the low and high-pressure cylinders of compound engines, the influence of the condenser making itself felt in the intermediate receiver, with which, of course, it has nothing to do.

Once more I would ask your readers to cite direct experimental proof that steam is condensed by the performance of work in a steam engine, if such proof is available. Thermal Unit.

Cambridge, August 23rd.

AMERICAN LOCOMOTIVES IN AUSTRALIA.

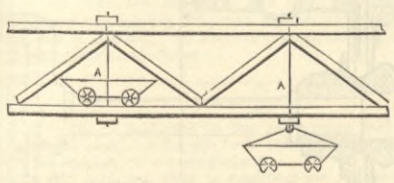
Sir,—Your correspondent, "A Colonial Locomotive Superintendent," while placing no reliance upon the report of the United States Consul at Sydney, does not make a similar objection to the report of the New Zealand Commissioner of Railways, though he endeavours to explain it. He ignores the succeeding sentence, quoting the words of the engineer-in-chief of the Victorian Railways:—"I did not go to the States at all prepossessed in favour of American engines, but what I saw there satisfied me that for the light railways of this country they are better adapted than any other kind." The little-studied second report of the Royal Commission on Technical Instruction says:—"The American locomotives may fairly be said to embody the principles of scientific construction in every part, together with the highest class of workmanship and the best of materials. There are many different conditions of service in America not often found in Europe, particularly the imperfect permanent way. The strength of a locomotive has had to be combined with flexibility to ensure safety. As with all machinery manufactured largely in duplicate, the uniformity of parts has received the closest attention in designing locomotives, so that the cost of repairs is minimised. These three reports corroborate each other in a remarkable manner. The quantity of locomotives exported by an English maker in 1885 is no criterion of the English trade in exported locomotives in 1886. May not the fact that the American manufacturers study the tastes and wants of customers, while the English do not, be an element in the case? C.

Westminster, S.W., August 23rd.

STRESSES IN A CAMP STOOL.

Sir,—I quite agree with "X." that the question he has put is more important than appears at first sight. The spring is of course used simply to illustrate the problem, and not as something occurring in actual practice. In this last the longitudinal elasticity of the bolt plays the part of the spring.

In a trussed girder we have tension members, which are screwed up tight to get the proper form of girder. Let us suppose that such a tension member has a stress on it of 3 tons per square inch, due to the dead load. When the rolling load comes on it, it is submitted, let us say, to another ton per square inch. Is this to be regarded as something added to the existing load, or is it not? Are we to suppose that, because the spring bolt of the truss is already exposed, say, to a tensile stress of 3 tons, no further strain can be put on it less than 3 tons? To me such a proposition seems to be absurd. Let me suppose a case:—

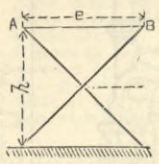


Here A A are two spring bolts on a timber truss carrying the rolling load on the bottom boom. It will be seen in a moment that the bolts, being screwed up tight, are in just the condition of the bolt in "X.'s" problem.

Let the initial or dead weight strain on each bolt be 5 tons, and the rolling load strain supposed to be put in the shape of a ton in a truck. In the one case this ton stands on the rails over the lower boom, as shown; in the other case it is hanging from below from an eye, just as in "X.'s" sketch. It appears to me that the effect on the bolt will be just the same in one place as in the other, and that in each case an extra pull equal to one ton is put on the bolt. I am sure that all engineers make their calculations on this assumption. I shall be glad to hear what can be said on the other side. If rolling load stress can be, so to speak, swallowed up in initial stress, then it will be possible to make structures of various kinds much lighter, and at the same time stiffer, than they are now. But for my part I do not believe it. E. J. Wilson.

Bristol, August 22nd.

Sir,—I propose the following solution about the stresses in a camp stool:—I suppose the line A B a right one, which is not possible, but gives the maximum stress on the legs. We have now the force on line A B $= P\left(\frac{\text{Weight}}{4}\right) \times \frac{l}{h}$. I suppose the leg a piece on two bearings—



The moment is $\frac{P \times l \times h}{2h} = \frac{P \times l}{2}$.

Then $\frac{P\,l}{2} = k\,\frac{6\,h^2 - b'\,h'^2}{6}$.

$k = 6$ tons.

$6 \times h =$ across section of legs.

$6' \times h' =$ across section of pin-hole.

Terni, Italy, August 16th. Bardea Luigi.

Sir,—Your correspondent "X." does not understand the problem he puts, or he would have stated the amount of spring in the beam A and the spring B. Assuming, however, that for every ton of upward pressure the centre of B rises $\frac{1}{100}$in., while the same downward pull bends the spring and stretches the bolt D so much that the nut *d* moves downward through $\frac{1}{10}$in., then it is evident that in order to put a strain of 5 tons on the bolt the nut *d* must have been screwed up $5\left(\frac{1}{10} + \frac{1}{100}\right)$ inches. If, then, a ton weight is hung on the bolt, there must be a difference of one ton of pressure between *c* and *d*. Let *n* tons be the pressure at *c*; then it is $n - 1$ at *d*, and the relative displacement at this point as compared with the beam B, is

$$\left(n \cdot \frac{1}{10} + (n-1)\,\frac{1}{100}\right) \text{inches};$$

but as this is still the same distance as before, viz.:

$$5\left(\frac{1}{10} + \frac{1}{100}\right),$$

we have

$$n\left(\frac{1}{10} + \frac{1}{100}\right) = 5\left(\frac{1}{10} + \frac{1}{100}\right) + \frac{1}{100}$$

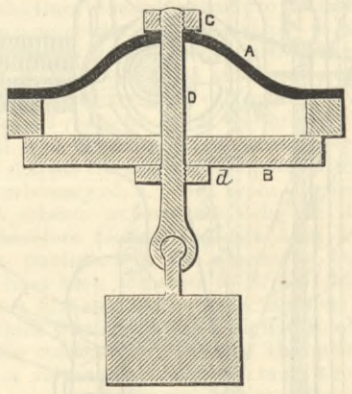
$$n = 5 \cdot \frac{\cdot 12}{\cdot 11} = 5{\cdot}45 \text{ tons}.$$

At D the pressure is one ton less. If B is not ten, but a hundred times more rigid than A, the pressure at *c* would have been

$$5 \cdot \frac{\cdot 102}{\cdot 101} = 5{\cdot}1 \text{ tons}.$$

London, August 19th. C. E. S.

Sir,—In reply to your correspondent "X," he is evidently wrong in his first assertion that there is a stress of 6 tons on the top nut. Since by the pressure of the spring there is an upward reaction on the bar B of 5 tons; hence, hanging weights on the bolt simply



partially relieve the bar from upward pressure. It is quite evident that if a weight of 5 tons were hung on the bolt, the bar B might be dispensed with altogether. The stress on the bolt at the upper nut will always be 5 tons, provided that no greater weight than 5 tons is hung on the bolt. B. C.

August 21st.

FIVE UNITED STATES WAR SHIPS.

The tenders for the construction of the Newark, cruisers Nos. 4 and 5—to have a speed of 19 knots—and gunboats Nos. 3 and 4, were opened by the Secretary of the Navy in the presence of a large number of gentlemen. The number of bidders was unexpectedly small. The following is a statement of the bidding in brief:—

Cruiser No. 1, the Newark.—William Cramp and Sons, 1,248,000 dols. under Class 3, department's hull, bidder's machinery; no bids for Class 1, department plans for hull and machinery, or Class 2, bidder's hull and machinery.

Cruisers Nos. 4 and 5.—Class 1, department's hull and machinery, William Cramp and Sons, 1,410,000 dols. for each vessel; Union Ironworks, 1,428,000 dols. for one vessel. Class 2, bidder's hull and machinery, William Cramp and Sons, 1,325,000 dols. for each vessel. Bidder offers plans and specifications of the hull of cruiser No. 3, displacement 4100 tons, with modification of protective deck to conform to the department's weight of plating for cruisers Nos. 4 and 5; also plans for boiler and machinery—cruiser No. 3 has displacement of 4400 tons. Also offer to build, under the same class, the two vessels for 1,350,000 dols. each, the plans embracing certain modifications of the hull of cruiser No. 3, and bidder's specifications for boiler and machinery. Class 3, department's hull and bidder's machinery, William Cramp and Sons, 1,405,900 dols. for each vessel.

Gunboats Nos. 3 and 4.—Department's plans for hull and machinery, William Cramp and Sons, 495,000 dols. for each vessel; N. F. Palmer, jun., and Co., of New York, 490,000 dols. for each vessel. No bids for the other two classes.

It will be seen that there was only one bid for the Newark; that the Union Ironworks of San Francisco, made only one bid for a single 19 knot cruiser; that Messrs. Cramp and Sons were bidders on all the vessels; and that N. F. Palmer, jun., and Co., representing the assignees of John Roach, were the lowest bidders on the two gunboats. In regard to the last-mentioned vessels it was immediately clear that the contract must go to Palmer and Co. It is understood that the hulls of these two vessels will be constructed at Chester. This result was in the nature of a surprise, as it was supposed that the Messrs. Cramp would secure these vessels without sharp competition. In regard to the Newark there seemed to be no question that the contract should be given to the Messrs. Cramp, and the only question to be decided, therefore, was whether this firm should have both or only one of the 19-knot cruisers. Mr. Irving M. Scott promptly made a formal claim to be allowed the contract for one of the 19-knot vessels in accordance with his bid, to be constructed according to the department's plans both as to hull and machinery. The evident preference of Messrs. Cramp was to build both these vessels under its second proposition, which provides for the placing of engines of their own design in hulls built on the same plans as the Baltimore, now building by them, the only difference being a decrease of 1in. in the thickness of the steel deflective deck. Their modified proposition, which made the price 25,000 dols. more for each vessel, gave a steel deck exactly like that in the Baltimore, with rigging and armament exactly similar to that of the Newark. The decision of the department will be announced by-and-bye, and it is expected will be to give the Messrs. Cramp one cruiser of the description last mentioned, and the other to the Union Ironworks, in view of the provision of law, which practically directs that one vessel shall be built upon the Pacific Coast. This decision will doubtless meet with general approbation, although it will not give entire satisfaction to the Messrs. Cramp, who are certainly showing a very commendable disposition to meet every demand which the Government may make for the building of new ships of war.—*Army and Navy Register.*

Technical Education.—An English engineer engaged on engineering work and in works in Italy, writing to us on the technical education question, says:—"From my experience I am convinced that it is not what is called technical education that is required to enable the Englishman to compete favourably with foreigners. For instance, I have a piece of work to be done; I explain precisely what I want, and give the workman a detailed sketch. With the Englishman it would be done without further trouble to me, he would grasp the situation, and do it well and quickly. But if I am dealing with a foreigner, it would take considerably more of my time explaining what I wanted; and I should also have to explain how the work is to be done, and then, when started, the job would be longer in hand; however, it would be as well done in the end. But as an employer, I should want to get my work done as cheaply as possible; and then I find that, although the Englishman in England does the work in less time, it is far cheaper to have the work done by an Italian in Italy, who works much longer hours and for much less pay."

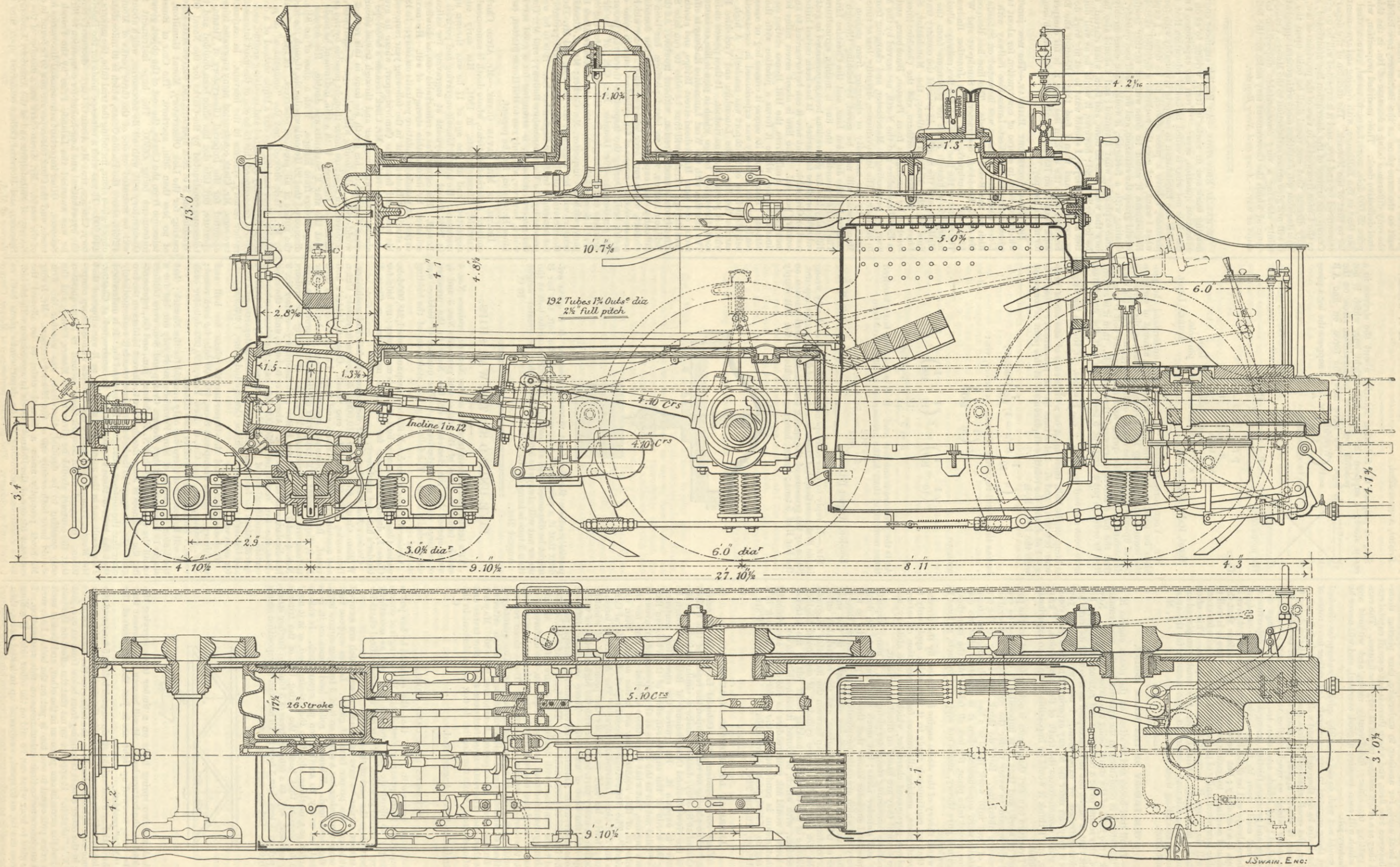
The New Southport Railway.—The new junction railway, which has been in course of construction for about two years, and which connects the West Lancashire Railway with the Cheshire Lines Extension Railway, was inspected on Saturday by Colonel Rich for the Board of Trade. The line has been constructed by Mr. C. E. Braddock, contractor, of Southport and Wigan, for the Liverpool, Southport, and Preston Junction Railway Company. The object of the line is to join the two railways alluded to, and so to provide a through route for passengers from the North to the Midlands and the South. At present the country traversed by the lines of the Midland Railway, the Manchester, Sheffield, and Lincoln, the Great Northern, and the Cheshire lines, can only be reached by passengers from Preston, Blackburn, and most places in East Lancashire and the North, not served by the Midland Railway, by proceeding to Manchester, and changing from one station to another. The inconvenience, difficulty, loss of time and expense caused by the necessity of changing from station to station in Manchester will now be saved, by booking through *viâ* the West Lancashire, the Junction Line, and the Cheshire Lines Extension. The land surrounding the line is mainly agricultural, and great difficulty has for generations been experienced in getting the agricultural produce to market. It has been carted hitherto to Liverpool or Ormskirk. But now it can be forwarded to any part of the country per rail. The line is about seven miles long. It commences about a mile from the Hill House station on the Cheshire lines Extension, where it forms a junction with the railway just named. Throughout its course it crosses bog or moss land, but no really serious difficulty was experienced in construction until the neighbourhood of Southport was reached. A high embankment carries the line to the Lancashire and Yorkshire Railway, over which it passes on a fine viaduct. It then passes under Meols Cop-road, through a bridge which in plan is like an immense star-fish. The junction with the West Lancashire Railway is effected by two forks, one near Hawkshead-street Bridge, and another near Roe-lane Bridge. Trains will thus be able to run into Southport, or directly on towards Preston, without trouble. At the Meols Cop Bridge a station, with an island platform has been built. Much difficulty was experienced in getting in the foundations for the viaduct, which runs over boggy ground, and for which foundations are secured by means of 6ft. cylinders, sunk in some cases 63ft. to a clay bed. During the inspection there were present the following gentlemen:—Sir Douglas Fox, C.E., of the firm of Sir J. Brunlees and Sir Douglas Fox, the engineers for the company; Mr. W. G. Scott, C.E., representing the Cheshire Lines Railway Company, with his inspector, Mr. Corker; Mr. C. Braddock, the contractor, with his engineer, Mr. Phillips; and Mr. Thomas Gilbert, the secretary of the company. The line will probably be opened for passenger traffic on September 1st. It is to be worked for the present by the West Lancashire Railway; and Mr. Thomas Gilbert, the general manager, is arranging for a good service of trains, which, however, will only run to Hill House Station, on the Cheshire Lines Extension, for the present.

Death of Mr. Alvan Clark.—Mr. Alvan Clark, M.A., the eminent American optician, whose death is announced, was born at Ashfield, Massachusetts, in 1804. His early education was neglected, and at the age of 17 he was thrown upon his own resources. He taught himself engraving and portrait painting, and in 1826 found employment at engraving for calico printing at Lowell. His career was a remarkable one, as showing what may be achieved by indomitable strength of will. He next became an expert at painting miniature portraits on ivory. In 1835 he opened a studio at Boston, but in the following year removed thence with his wife and family to Cambridgeport, where he ever afterwards continued to reside. Mr. Clark became a telescope maker in an almost accidental manner and through trivial circumstances, but some time before his death his fame in this respect had become world-wide. Beginning with telescopes of small sizes, he at length achieved an aperture never thought possible by the great telescope makers of Europe. With a 4½in. instrument he made the discovery that the star 8 Sextantis was double. His success brought him large orders from Europe. With a glass of an 8¾in. aperture he discovered that 99 Herculis was double, though the fact had escaped the notice of all previous observers. In 1856 a further discovery by Mr. Clark showed that the "companion" of μ Herculis was double, thus making the star a triple instead of a double, and all three physically connected and revolving around each other. Otto Struvé pronounced this to be one of the most interesting binary, or rather ternary, systems in the heavens. In conjunction with his two sons, Mr. Clark constructed many enormous telescopes. That executed for the Imperial Observatory of Vienna was of 12in. aperture, but this size has since been doubled and trebled. The telescope constructed by the Clarks for the Naval Observatory at Washington is of 26in. aperture, and the celebrated instrument now making for the Lick Observatory, Mount Hamilton, California, is of no less than 36in. aperture. The Czar of Russia ordered a telescope from the Clarks, the cost of the object glass alone in this instrument being £6500. The huge instrument for the Lick Observatory will, with all its accessories, weigh about 14 tons. It will be mounted on one of the three peaks of Mount Hamilton, 4256ft. above the Pacific Ocean, which is 40 miles distant. For the object glass alone, including the trial tube, the makers are to receive £10,200. It was with a telescope made for the Dearborn Observatory, Chicago, that Mr. Alvan G. Clark—deceased's son—discovered the hypothetical and long-looked-for companion to Sirius, for which he was awarded the Lalande Prize by the French Academy of Sciences. Other important astronomical discoveries have also been made, and the Clark telescopes are now to be found in every quarter of the world. Mr. Alvan Clark was a member of the Philosophical Society of Philadelphia and of the American Academy of Arts and Sciences, and Harvard College conferred upon him the honorary degree of M.A.

MANCHESTER EXHIBITION—PASSENGER ENGINE, LANCASHIRE AND YORKSHIRE RAILWAY.

THE VULCAN FOUNDRY COMPANY, NEWTON-LE-WILLOWS, ENGINEERS.

(*For description see page* 179.)



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CONTENTS.

TO CORRESPONDENTS.

Registered Telegraphic Address "ENGINEER NEWSPAPER, LONDON."

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

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

C. J.—*Your sketch shows a very old device for lowering ships' boats at sea.*

G. S. H. (Bristol).—*We have failed to find any difference between your invention and that used during the American Civil War on board blockade runners built on the Thames.*

Engineer.—*It is impossible to render molten cast iron viscous in the way you suggest. When it is nearly on the point of solidifying it is approximately plastic for a very short time.*

R. McL. (Delahay-street).—*You must be more explicit. Your illustration, as we understand it, does not apply at all to "X.'s" question. Does he or does he not put an additional man at each end of the rope?*

W. R.—*So far as we know, there is no truth whatever in the rumour. It would be practically impossible to run a train of any weight at 63·5 miles an hour for two consecutive hours, with the necessary punctuality, in all states of the weather and the road.*

NON-CONDUCTING SILICATE COTTON.

(To the Editor of The Engineer.)

Sir,—Will any correspondent give the name of makers of non-conducting silicate cotton?—and oblige, T. G. and C.

London, August 17th.

LEAD SHOT AND TIN CANISTER MACHINERY.

(To the Editor of The Engineer.)

Sir,—Can any of your readers give the names of makers of lead-shot making machinery; also of makers of machinery for making tin canisters, &c.? K.

London, August 22nd.

PIPE CORES.

(To the Editor of The Engineer.)

Sir,—Can you or any of your readers give me the information as to the best method of making cores for cast iron pipes cast horizontally?

Lancashire, August 24th. A Constant Subscriber.

THE SHAPE OF CHIMNEYS.

(To the Editor of The Engineer.)

Sir,—The proper taper to give a chimney on the inside has often puzzled many besides myself. It might be interesting to get the opinions, and reasons for their opinions, from some men practically acquainted with those useful, if sometimes inelegant, adjuncts to modern civilisation. The tendency now seems to be to make the inside as nearly cylindrical as possible, thus sacrificing beauty and strength presumably for a more efficient draught. An Outsider.

Watford, August 23rd.

FERRY STEAMER RUNNING BOTH WAYS.

(To the Editor of The Engineer.)

Sir,—From your article of August 12th, page 128, about the Ryde ferry steamer, I notice that it runs a quarter of a knot slower back than ahead, which it seems you attribute to the form of the floats. From a similar steamer I have the experience that with the same number of indicated horse-power the steamer made a little more speed astern than ahead. In this case the axle of the paddle wheel was 7ft. out of the middle of the ship, which else was completely symmetrical to the middle spant, and I accounted the difference of length, as given, for the difference of speed.

Will any of your correspondents kindly give their experiences about this question on the speed of double-ended steamers?

An Advocate for Double-ended Ferry Boats.

Aarhus, August 18th.

LONG STRUTS.

(To the Editor of The Engineer.)

Sir,—Will some one kindly help me in the following? On page 524, "Machinery and Mill Work," by Professor Rankine, I find a formula for strength of long struts as follows:—

$$\frac{P}{s} = \frac{f}{1 + \frac{l^2}{c\,r^2}}$$

Where f = strength of material in lbs. per square inch, P = breaking load, s = sectional area, l = length, r = least geometrical radius of gyration of its cross section, c = a coefficient.

It is r^2 in the equation that is puzzling me. I cannot see what the geometrical radius of gyration of its *cross section* has to do with the crippling of the spar, there being no motion around its axis, the tendency being to turn around two points, *i.e.*, top and bottom. I should also like to know what the coefficient c is derived from. H. W. G.

Woolwich, August 24th.

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MEETINGS NEXT WEEK.

Association of Municipal and Sanitary Engineers and Surveyors.—The Midland District Meeting of this Society will be held at West Bromwich on Saturday, September 3rd. 11.15.—Meet in Council Chamber, Town Hall, by permission of the Mayor. Business:—Elect district secretary. 11.30.—Visit to Messrs. J. and S. Roberts' foundry—pipes, &c.—at Swan Village. 12 45.—Visit to Mr. Joseph Hamblet's brick and tile works, where light refreshments will be provided. 2.0.—Inspect the works in connection with the boating lake and swimming bath at Dartmouth Park. 2.45.—Return to Council Chamber; Mr. Chas. Jones, Assoc. Inst. C.E., of Ealing, to read a paper on "The Destructor"—discussion.

DEATHS.

On June 14th, at Karachi, Scinde, Henry Hughes Treppass, C.E.

On the 18th inst., at 33, The Avenue, Kew Gardens, Robert Mein Henderson, Civil Engineer, Public Works Department, India, late of Thayetmyo, aged forty-six.

THE ENGINEER.

AUGUST 26, 1887.

RAILWAY ENTERPRISE IN TURKEY.

For a long time past it has seemed as if the mileage of railways within the Ottoman Empire was doomed to remain stationary. It was the more difficult to account for this stagnation, because it was well known that wherever railways had been carried out in that empire the district served had experienced very material improvement, and the lines themselves had proved fairly remunerative. There is no country, perhaps, that—to judge from the experience already gained—more demands railway facilities, or has shows itself to be more appreciative of them, than does the Asiatic territory of Turkey. With the details of the proposed route to India by the Euphrates Valley we are all well acquainted, nor are there many to be found who dispute the arguments upon which its proposers base their advocacy of it. But from a variety of causes this great scheme experiences delay in its realisation. We are therefore pleased to learn that by an imperial Irade just published in the *Gazette* of Constantinople, privileges have been accorded to British financiers which will enable a first step to be made towards securing the benefits which that route was designed to obtain.

The Irade referred to concedes the privilege of constructing a railway to Bagdad, and those who have studied the question of providing an alternative route to India through Ottoman territory to the head of the Persian Gulf, will recognise what material aid this concession will afford towards the full ultimate execution of that scheme. A letter from Constantinople assures us that the new line, besides opening up many important and wealthy districts and towns throughout its course, will "bring India closer to England by some four or five days, thus providing a mail route shorter than either the Pacific or the Siberian." Whether it may eventually prove to be desirable that an Indian mail service should be organised by this new route, is a question upon which we do not feel prepared to enter. There may be, and certainly are, many considerations to be given to such a proposal which may not have occurred to the writer of the letter from which we quote; but the fact is incontestible that the advance of railway communication between Europe and India as far as Bagdad, will revive the hopes of those who deem mail conveyance *viâ* the Asiatic provinces of Turkey to India to be perfectly feasible. But apart from the prospect of obtaining a third alternative route to our Indian possessions which the late determination of the Sultan and his advisers has now opened out, we may regard with extreme satisfaction this new enterprise as certain to do much towards relieving the deadlock in prosperity which has so long oppressed the fertile provinces of Asia Minor. These are understood to be among the most productive territories of the world; and yet it is a well-known fact that, year after year, the crops produced in them are allowed to rot upon the ground, owing to the impossibility of conveying them to a profitable market.

The evil this want entails is well illustrated by a single instance given in the letter from which we have above quoted. Its writer informs us that "a sum of not less than £3,000,000 is annually spent abroad in provisioning Constantinople in respect only to three articles of consumption—flour, butter, and meat—when Anatolia is well capable of supplying the whole of Turkey in Europe with a large surplus for exportation." We are naturally glad to learn that it is to British enterprise that the removal of so heavy a disability is to be entrusted, the concession having been made to the present lessees of the Haidar-Pasha and Ismid Railway. Those acting with them contemplate bringing in the line from Haidar-Pasha to Scutari, so as to offer a port at its northern terminus protected from wind and sea at all seasons. This part of the work is to be commenced forthwith. In connection with the whole scheme we learn that a very important decision as to the character to be given to the lines has been arrived at, and this has doubtless been largely based upon the ascertained results to experience of late years in India. The Military Council of the Sultan is said to have strongly advocated their construction upon a narrow gauge; but full survey and inquiry proved that, although this might be cheaper in first cost mile by mile than a broad gauge, it would entail, as on the present Adrianople Railway, the traverse of nearly twice the actual distance to avoid physical difficulties. If to this fact—which is said to have been fully ascertained—be added the considerations as to weight, conveyance, &c., which are now inducing the change in many parts of India of established railways in that country from the narrow gauge on which they were first constructed to a broader one, we can well approve the determination of the Sultan to face first cost rather than expose the system to consequences which might ultimately cause a large increase upon it.

We may, we believe, see in the concession granted a strong desire on the part of the Government of Turkey to entrust the future of its railway extensions to British enterprise. It is well-known that for a long time foreign influences have been strongly competing in the endeavour to obtain this new opening for other nationalities. We have, of course nothing to say on the political aspect of the Sultan's act. It is sufficient that we recognise in it the opening of a fresh field for British skill and industry; and, as constituting such, we may well congratulate ourselves on the disposition shown by the Porte to cling to the old traditions which have so long united the Governments of Turkey and Great Britain. We may feel assured that even before the new railway reaches its terminus at Bagdad, British *entrepreneurs* will be active with the object of extending it further towards the Persian Gulf. The route to India, therefore, that has so long been advocated will probably by this independent concession find advancement from a quarter from which but little help was to have been expected. It may not fulfil all the desires of those who have struggled so persistently towards the realisation of their designs, but it must contribute greatly towards ultimately obtaining the fulfilment of them.

MARINE ENGINES FROM THE SHIPOWNER'S POINT OF VIEW.

That the triple-expansion marine engine requires less coal per ton mile is a fact about which there is no longer any dispute. Every engineer and shipowner admits so much. As to fuel, indeed, the only question is whether the triple engine saves 15, 20, or even 30 per cent. as compared with the compound. It is safe to say that the saving reaches quite 20 per cent.; but beyond this all seems to be uncertainty, and no one appears to know precisely to what the saving is due. This arises from the circumstance that the conditions under which a ship and her engines work are very complex, while it is quite impossible to obtain precise data. What is really known is that of two ships, one fitted with compound engines, working at 80 lb. or 90 lb. per square inch, and the other fitted with triple engines, working at 150 lb., and both engaged in the same trade, and supplied with similar coal, the latter will cost some 20 to 25 per cent. less for coal than the former. The conclusion hastily arrived at, because it is the most obvious, is that the triple engine uses less steam per indicated horse-power per hour. When, however, we come to examine the basis on which this theory rests, we find much to cast doubt on it. While a ship is on her trial trip indicator diagrams are taken, and these are compared with the coal burned, the weight of which is obtained very roughly. If we test some of the statements made setting forth results obtained in this way, we find, first, that they are wildly improbable; and secondly, that very much the same statements have been made very freely concerning compound engines. We have old logs of the performance of compound engines lying before us, which show that long voyages were made with less than 1½ lb. of coal per horse-power per hour. No one believes now that any such average long voyage performance is possible. It is not too much to say that no one has ever yet made a twenty-four hours' run, the coal being really weighed and the engines properly indicated, which gave as a result anything like the small consumption frequently claimed for the triple engine. Indeed, such trials are excessively rare, the records of two carried out by Messrs. Cockerill and Co. were given by us at considerable length in The Engineer about two years ago. Before we attribute the whole saving to greater engine efficiency, in the sense of using less steam per horse power than the compound engine does, we must bear in mind that there is no scientific proof of such a theory available, and that the efficiency of the screw and engines taken together never exceeds 50 per cent., and very often is much less. If the push on the thrust block is multiplied by the speed of the ship in feet per minute, we get a certain horse-power, which will in all cases be less than half the indicated power of the engines. A very valuable paper was read by Mr. J. P. Hall last April, and discussed last May before the North-East Coast Institution of Engineers and Shipbuilders, on compound and triple expansion engines from a shipowner's point of view. In that paper a table is given in which are particulars of engines indicating 1000-horse power and propelling a ship at 10 knots; the speed represents 1009ft. per minute. Now, 1000-horse power = 33,000,000 foot-pounds per minute, and $\frac{33{,}000{,}000}{1009} = 32{,}705$ lb. as the thrust of the screw; but in reality the thrust will probably not exceed 15,000 lb. Here we have an enormous margin. A large part of the waste is due to the screw, but a considerable portion remains due to the difference between the indicated power of the engines and that actually transmitted to the screw, the waste being due to friction, power required for working pumps, &c. &c. Let us put this loss at 15 per cent. It can hardly be less, and may be

much more. Then of the 1000-horse power indicated only 850 reaches the screw; of this the screw loses 350-horse power, then we have 500 left as measured at the thrust block. If, however, the engine wasted only 10 per cent., then there would be 50-horse power more available for driving the ship, and as all the losses due to the screw are provided for already this would represent a clear gain of 10 per cent. in propelling power, and would reduce the shipowner's coal bills by 10 per cent. at once, although the actual consumption per indicated horse-power remained the same in both cases. Now, very able practical engineers hold that the three-crank engine transmits more of the indicated horse-power to the screw than any double-crank engine can, and if this be true—and a very good case is made out for the theory—then it is evident that the superior economy of the triple engine from the ton miles per ton of coal from the shipowner's point of view, is due not wholly to less steam being used per horse-power, but to that and the greater efficiency of the engines and propeller taken together.

The discussion which followed Mr. Hall's paper brought out very prominently the uncertainty which exists in men's minds as to the performance of the triple and compound engine, and the curiously-involved nature of the questions which present themselves at every turn. For example, Mr. Hall claimed for the triple engine that it was 5 per cent. lighter than the double engine, mainly on the ground that the steam worked more effectively. But Mr. Blechynden, criticising the table of particulars given by Mr. Hall, showed that the reason why the weight of a triple engine could be kept down to that of a double engine was that the triple engine ran faster by about 11·5 per cent.; making, according to Mr. Hall's own figures, an average for a number of engines 72·5 against 65 revolutions for the double engines. Mr. Hall claimed that engines and boilers together, ready for sea, weighed about 460 lb. per indicated horse-power; but Mr. Blechynden pointed out that these figures were based on trial trip powers, which were much too high, and that the true weight would work out commercially at about 552 lb. per indicated horse-power. Another example of the confusion of mind which exists because of the want of proper data was supplied by Mr. Tweedy. Mr. Hall gave particulars of two ships, marked in the table as R and N. "If," said Mr. Tweedy, "we compare R and N, the efficiency of engines N is set down as 25 per cent. more than those of R, as measured by the quantity of cargo carried per ton of coal; but, as a matter of fact, the real consumption was 7 per cent. less, or a difference of about 30 per cent., due entirely to the difference in hull."

We have said that the triple engine runs faster than the ordinary compound. It follows, of course, that the propeller must have a finer pitch, the speed of the ship remaining the same. Here, then, we have another possible element of economy concerning which no one says anything. It will naturally and reasonably be asked why the ordinary compound cannot be run as fast as the triple engine. One answer is, that it is impossible to balance the former as effectively as the latter; three cranks, giving an absolutely equal turning moment—if matters are properly arranged—as far as the weights involved are concerned. But we venture to think that this is not the whole of the truth. The engines built for 150 lb. pressure are, on the whole, better and more carefully built than their immediate predecessors; steel is freely used in them. It was clear that if the triple engine weighed much more than the compound it would not be popular with shipowners, and it would cost a good deal more than the compound. With the direct object of saving expense and the indirect object of saving weight on board ship, all the parts of the best triple engines have been carefully studied, and they have been made lighter and run faster than was the old practice. Apart altogether from the merit or demerit of the way in which the steam is used, the modern marine engine is a better piece of mechanism than its progenitors, and this fact ought not to be lost sight of when even we compare the two types of engines.

There is much about which we have said nothing that deserves consideration in Mr. Hall's paper and in the discussion upon it. It is one of the distinguishing features of the North-East Coast Institution that its members are eminently practical, and this gives great value to their discussions. The paper under consideration is no exception to the general rule, and we shall have more to say about it. Meanwhile we must ask, who is the independent engineer who will test a triple expansion engine on a proper basis, and so provide data which are now entirely wanting? The test could be made in the shop with a Froude brake. It would not be necessary to send the engines to sea. A better way would, no doubt, where it is possible, be to moor the ship alongside a quay wall and then run her engines. Much more is wanted, however, than a mere test for coal consumption; we want the water consumption; and this can of course only be ascertained by pumping from the hot-well into a measuring-tank. The cost of the experiment, if properly carried out, would amount to some hundreds of pounds sterling. But it ought not all to fall on one firm. If eight or ten firms combined and subscribed £50 each, the thing could be easily done. A proper committee could easily be appointed to report, and in three days and three nights a fund of information might be obtained of extreme value. Of course, to make the test complete, a double cylinder compound working, at say 100 lb. pressure, ought also to be tested, and the results compared. May we suggest that there is no body of men in the world more competent to carry out such an experiment than the members of the North-East Coast Institution of Engineers and Shipbuilders.

PETROLEUM REFUSE AS A FUEL.

Many of our readers have taken a lively interest in the substitution of petroleum for coal as a fuel. We specially commend what they will find in our "Abstracts of Consular Reports," which appears on p. 168, to their attention. The British Consul supplies a great deal of valuable information on the subject, and the facts and figures which he gives show that the value of astatke, or petroleum refuse, may be much over-estimated. It is admitted on all hands that mineral oils cannot be used to raise steam; in the first place because they are too dear, and in the second because they are too volatile, giving off vapours which would be extremely dangerous. The fatal explosion which took place last year in Liverpool, on board a petroleum ship carrying the oil in bulk, is a highly suggestive fact which can neither be overlooked nor explained away. The dead oil, or astatke, a residual product analogous to the coke of our gasworks, is held to be competent to take the place of coal on board ship, and the success which has attended its employment in Russia has been pointed out as convincing testimony in its favour. We have repeatedly said that it was quite beyond dispute that astatke could be used as fuel with success under certain conditions, but that its steaming power was over-rated and its cost under-rated, while special inconveniences accompanied its use, such, for example, as the tremendous roaring noise attending its combustion. Those who are interested in oil, or so violently progressive that they see in every change or suggested change on existing practice an improvement, have not agreed with us. The statements made by the British Consul more than justify everything we have written.

Great stress has been laid on the use of petroleum refuse on the South Russian Railway. It will be seen from the consular statement on page 168 that astatke, instead of possessing at least double the thermal value of coal, is only 44 per cent. better in practice, and the comparison is made not with good English, but with inferior Russian coal. It is safe to assume therefore that, theory to the contrary notwithstanding, astatke is practically not more than 40 per cent. better than coal. It is true that its use saves on the Griazi-Tsaritzin Railway about £40,000 a year, but it is a suggestive circumstance that the money value of both fuels per ton is the same, viz., £1 6s. 3d. If this is the price of astatke on the spot, we can imagine what its value would be delivered in England. That it is right and proper that it should be used on the Caspian and in South Russia, there can be no doubt, because really there is no other fuel available in one sense. But the conditions obtaining on the Caspian are not general in their operation. It seems, too, that astatke, instead of being a waste product turned out in prodigious abundance, is not always to be had when wanted. English coal costs, with the duty of 5s. 1d. a ton, 27s. 6d. a ton at Batoum, while astatke can only be had from Baku in barrels at a cost of nearly twice the price of coal for freight alone. "Petroleum residuum," writes the Consul, "to displace coal in the Mediterranean trade, would have to be delivered at Constantinople and Malta, because even if it were given away at Batoum, it would hardly be a sufficient inducement for vessels to spend six or seven days necessary to run from Constantinople to Batoum for fuel." He then gives an estimate of the cost of transport, and shows that the price could not be much less than 35s. 3d. per ton at Constantinople, where good English coal can be had for 22s. a ton. Of course, under these circumstances it is to the last degree improbable that any shipowner would attempt to substitute astatke for coal. It is stated, however, that a pipe line from Baku to Batoum will soon be constructed, refineries erected on the Black Sea coast, and enough astatke "given away to supply the world." Of course, if astatke can really be had for nothing, all the conditions will be changed, and cargo steamers, at all events, will burn nothing else. All this, however, is in the air, and we very strongly doubt that astatke will ever be supplied gratis to all who like to ask for it. Gas companies do not give away coke, nor have we ever heard of any waste product with which anything could be done, or out of which anything could be made, being given away. If the only chance of adoption as a fuel possessed by astatke depends on its costing the consumer nothing, then, indeed, the difficulties attending its use must be very great. Nothing stronger can be said against it. In the meantime the pipe line has to be laid, and the conditions by which the contractors are hampered are so onerous that it is not remarkable that so little progress has been effected.

As to the actual use of petroleum refuse on board ship, the Consul's statements do not bear out those that have been made freely enough in this country. According to one picture, the Black Sea is crowded with large steamers all burning astatke and nothing else. Our Consul tells us that "at present there are not more than half-a-dozen small steamers in the Black Sea using petroleum fuel; they run between the Russian Black Sea ports, and have been getting their petroleum residuum at Novarossisk at a cost of about 23s. 10d. per ton. It costs the sellers ten times that amount." There is, too, every reason to believe that the supply of astatke is limited. On the whole, we see no reason whatever at present or in the immediate future why shipowners or engineers should trouble their heads about substituting astatke for coal. It is a suggestive fact that the Russian Steamship Company, with the greatest number of steamers in the Black Sea, adheres steadily to the use of coal, and has altered none of its ships to use petroleum.

Our readers will do well to bear in mind that in many cases authoritative statements made in this country concerning petroleum as a fuel, emanate either from persons interested in the trade, or in some invention for burning the oil. It is only recently that much has been heard about it. For nearly twenty years after Mr. Aydon had patented his method of burning petroleum the subject was allowed to go to sleep. Its recrudescence dates from the development of the oil industry in South Russia. Now in the United States there are hundreds of refineries, and plenty of astatke, but little or nothing has been done in the United States all these years to use it instead of coal. How is this? Does it not point to the fact that there are difficulties in the way of the substitution of petroleum for coal which even astute Yankees have not yet overcome, or that difficulties connected with supply and demand stand in the way?

ENGINEERING EDUCATION, UNIVERSITY COLLEGE, BRISTOL.

Playing at work, irresponsible amateur imitation of things done in workshops, the utter impossibility of giving any air of importance to such occupation, and the difficulty of imparting really valuable theoretic information to young men who do not know what they want, make the education of an engineering student in the technical schools and colleges, as in most cases at present arranged, a very difficult problem, and one that is being met only in a most unsatisfactory manner. The proposals for a more adequate means of education of an engineer are numerous, but few have been so well calculated to gain what is required as that adopted by the University College, Bristol. It might be asked if our system of education is so unsatisfactory, how is it that we have any engineers able to compete with their foreign brethren, where education is said to be so good? But it may be replied, that the foreign system—Germany, for instance—is much better calculated to turn out draughtsmen, teachers, and schoolmasters, and clerks with a smattering of technical things which is useful to them in a merchant's office abroad, than to turn out engineers, and that men able to be engineers will educate themselves where education has fallen short. No engineering education can be complete, and upon a sound elementary basis the young engineer will or will not erect the superstructure if he is suited to the profession after going into the works. The Bristol University College has been recently enabled to make a notable advance in the matter of engineering education, owing to the generosity of local firms. At a meeting held in the early part of the present year, under the presidency of Albert Fry, Esq., the desirability of instituting engineering scholarships was considered. The practical outcome of this meeting was that most of the firms of the neighbourhood agreed to institute bursaries or scholarships at their works. The holders of these are to be nominated by the college authorities. Some will be awarded on the results of the annual examinations, while others will be reserved for deserving students who may be unable to pay the usual premiums required on entrance into works. The educational scheme adopted at Bristol does not include any attempt to impart practical workshop instruction within the college walls; but the students spend six months—April to October—in each year, acquiring practical experience in the works and drawing offices of the engineers of the West of England. This system is found to answer so well that Messrs. Stothert and Pitt, of Bath, and the Bristol Wagon Works Company, propose to make it obligatory on all their pupils to attend the college courses in the winter months for the first three years of their pupilage. Several firms have also signified their willingness to take college students for short periods, so that civil engineering and electrical engineering pupils may spend one or two terms of six months in works; while at the same time mechanical engineers may have experience in two or three different establishments during their college career. In return for these concessions, the council of the college has decided to permit deserving apprentices or artisans, nominated by the local engineers, to attend the college courses at reduced rates. It is expected that about nine first-class scholarships and a large number of second-class ones, will be available during the coming session. The following are the names of the firms which have already placed at the disposal of the college authorities one or more scholarship places in their works, on exceptionally favourable terms:—Messrs. Stothert and Pitt, Bath; the Bristol Wagon Works Company, Bristol; Messrs. Cox and Co., Falmouth; Messrs. Newall and Co., Bristol; Messrs. Willoughby Brothers, Plymouth; Messrs. Bush and De Soyres, Bristol; Thomas Peckett, Atlas Engine Works, Bristol; Messrs. John Watts and Co., Bristol; Messrs. Spencer and Co., Melksham, Wilts.

THE INSURANCE VALUE OF STEAMSHIPS.

The remarkable and inexplicable variation in the owners' assessment of the value of steamships for insurance purposes is a subject which has of late attracted much attention. In the cases of vessels insured in whole or part in the mutual insurance clubs, the "insured value" is stated, and is by some of the clubs published, so that a comparison may be easily made. And thus we find in one, a steamer of 1600 tons built in 1879, valued at £21,000—or roughly, £13 per ton—and another built in the same year valued at £10 per ton; one built in 1881 insured at nearly £14 per ton, another at £15 per ton, and another of the same year at about £12 per ton, and at other ports we have variations as great. For instance, a vessel built in 1874 is insured at about £15 per ton, and another built in the previous year is put down as worth over £20 per ton; whilst a third, built in 1879, is put down at about £15 per ton; another, built in 1881, is similarly valued; and some later built, and of similar class, as lower. Again, a vessel built as far back as 1872, is at one port valued for insurance at £12 per ton; another of the same age, class, and type, is put down at less than £9 per ton; and another, built in 1880, is valued at less than £9 per ton. Through a number of ports there are these variations, and that with no apparent cause; for the examples we have instanced above are those of vessels which would appear to be substantially alike. They are alike in age, in port of building, alike in material, and in the power of the engines as far as those particulars are obtainable, and thus there is no indication of any reason for the very great discrepancy in the value put upon them for insurance purposes. Apart from the question which has been so bitterly fought over—that of whether the amount of the insurance value has or has not anything to do with the very serious loss of property and life at sea—there is another point in which the variations in the values is very important. Much of the insurance of steamships is on the mutual system, in which the whole of the vessels insured contribute in equal proportions to the loss, or rather contribute at an equal rate per cent. to repay the loser of a vessel for the monetary value thereof. It is evident that in such a case the insured should not be the only person to determine the value of his vessel, for it is not in marine insurance as in fire insurance—there does not appear to be any power to make the policy of insurance a simple indemnity. If the insurance club could replace the steamer lost, with an allowance for the loss of interest, then the mere nominal value would be a matter of no concern to anyone; it would be only a means of assessing the contributions to other losses. But as it is at the present time, it is the defining by the insured owner of the vessel of the sum he is to receive if that vessel be lost; and it is clear that as the steamship grows older, and the expectation of its loss becomes greater, there is not that inducement to the owner to reduce the insurance value of the steamer that there ought to be when it is remembered that its "life" is working out by wear and tear, and that the value of the vessel is proportionately depreciating. It is not so much with the question whether there should be a minimum of value which should be uninsurable that the public is concerned; what is needed is that there should be some method either of determining the

value for insurance purposes, or some means of giving the companies and clubs the power of mere replacement to protect themselves against the payment of sums far too high.

SPANNING THE DEE.

By starting the sinking of the first cylinder of a new bridge from Connah's Quay across the Dee last week, Mr. Gladstone initiated a railway development of importance. The monopoly of the London and North-Western Railway in the Wirral Peninsula has been a grievance for a great many years among mine-owners and agriculturists throughout North Wales and Cheshire down to Birkenhead, owing to the rates which the London and North-Western Company have been able to exact with impunity. The Mersey Tunnel Railway and its extensions—which are now advancing rapidly—were an important step in the direction of breaking down this monopoly, but the new railway will go a great deal further than this, and will directly connect the valuable coal and iron districts of Wales with Liverpool, and thence with Lancashire, Yorkshire, and the whole of the North of England, and by competing with the present system it will bring down the rates, and so develope the at present hampered industries of the Principality. During the last twenty-five years numerous schemes have been before Parliament for crossing the Dee at this point, and in 1873 Parliament's sanction was given to a Bill for constructing a high-level bridge over the river and a line on to Birkenhead to join the mersey Tunnel, and also a line to Chester to join the Cheshire Lines system at that city. This project was not, however, carried out, but in 1884 the Manchester, Sheffield, and Lincolnshire Company obtained powers to extend the Cheshire Lines from Cheshire to Connah's Quay by means of a low-level opening bridge across the Dee, and in 1885 the Wirral Railway Company projected, by the co-operation of landowners all along the route, a railway from the Cheshire side of the Dee direct to their new station at the Birkenhead Docks. In the next place the Mersey Railway Company came to an agreement with the joint lines at Chester for making their permanent junction at Rock Ferry, and the bridge which has been commenced is the final outcome of all these arrangements for connecting Wales, Cheshire, and the North of England. This new bridge will cross the Dee at a point where the river is 480ft. wide. The swinging girder will be 287ft. long, at a height of 16ft. above the water, the clear opening span being 140ft. long. It is stated that the bridge will be longer by 35ft. than any existing opening bridge spanning a navigable river in the United Kingdom. The piers are to be constructed on the Indian system of brick wells, by which the employment of iron between "wind and water" is avoided. The girders are to be of mild steel, and consequently the moving mass, when the bridge is being opened or shut, will not exceed 850 tons. By adopting hydraulic power with water under a pressure of 700 lb., the bridge will be opened or closed in forty seconds. The estimated cost is from £70,000 to £80,000, and it is expected that the work will be completed by the autumn of next year. Mr. Francis Fox, of Westminster, is the engineer, and Messrs. John Cochrane and Sons, of London, are the contractors.

THE THAMES AT RICHMOND.

The only remedy for lowness of water in the Thames between Teddington and Richmond, is, in the opinion of the Richmond Select Vestry, a lock and weir situated near Isleworth. The condition of the river was the chief subject for discussion at the meeting of that body last week. Being dissatisfied with the policy of dredging hitherto pursued, and which, according to Mr. Ritchie's recent statement in the House of Commons, is to be continued, the vestry, with a view to remedy, resolved to ascertain if the powers of the Thames Conservancy are not subsidiary and amenable to the control of the Local Government Board or the Board of Trade. They also decided to send a request to the President of the Local Government Board, and to other members of Parliament interested in the district, inviting them to inspect the deplorable state of the river at low water. That something must be done, and that without delay, is becoming the opinion of more than one local body on the river side. A nucleus for concerted action has been formed by the coalition of the Twickenham Local Board and the Richmond Vestry, who have now both set their respective surveyors to work to ascertain how the river really does compare with normal average conditions. This matter is by no means a new one. The engineering world have heard about it in previous years, but there seems good reason for believing that it is likely soon to be settled. The Conservancy Board doubtless honestly do their best in the interests of the river generally, and if they can see their way to fall in with the wishes of the inhabitants of Twickenham, Richmond, and Isleworth, consistently with their duty to other portions of the stream, they will probably endeavour to do so. In the localities most interested a lock and weir is considered the remedy for scarcity of water, and a lock and weir is pretty sure in time to be constructed. A member said it was a question whether they should not offer a premium for a new form of lock. The state of the river between Richmond and Putney was peculiar, and required special treatment. There were several locks abroad, like the Anderton canal lift, which were of the kind that was wanted; and there was one at Auxerre on the Yonne. What was wanted was something that would lie down in winter, because it would only be required in summer. £250 would perhaps be a reasonable premium to offer if good advice was sought. This suggestion was received with some degree of favour by the Board, who, should occasion require later on, would probably not be slow—in conjunction with Twickenham and other neighbouring towns—in adopting it. The matter, however, was not considered quite ripe enough for such a step yet.

THE NEW CANADIAN IRON AND STEEL DUTIES.

"British iron and steel manufactures, to the value of millions of dollars annually, will be still admitted into Canada free, or at a low rate of duty." So runs the most pacific portion of the important reply of the Committee of the Canadian Privy Council to the Colonial Secretary concerning the protests made by the members of the English iron and steel trades against the recent increases in the Dominion tariff. The reply is of deep interest, and is convincing that in the course she has taken Canada has been actuated by a determination to foster home industries. Our own iron and steel masters should give close attention to the Canadian Committee's report. It shows that in 1868 Great Britain did fifty-eight per cent. of the business with Canada in four classes, comprising the higher forms of iron and steel goods imported, while the United States did forty-two per cent. That trade has since become so revolutionised that during the decade ending last year the proportion has been seventy per cent. for the United States and thirty per cent. for Great Britain. The Privy Council remark that under these conditions the pertinent question to be considered was: "How shall Canada overcome her increasing dependence upon foreign resources for her enormous annual requirements of iron and steel?" The answer to the question has been furnished in the increase in the tariff of 100 per cent. on pig iron, 155 per cent. on bar iron, and 350 per cent. on puddled bars. Canada's rich and varied mineral resources are, the Privy Council plainly tells us, to be developed, and there is no gainsaying the truth of the argument that in taking the step she has done the Dominion "is but following the methods adopted by Great Britain, France, Belgium, Germany, the United States, and other countries which have succeeded in promoting a great iron and steel industry." It is satisfactory to know, however, that in many branches of the iron and steel trades Canadian imports from England will be large for many years yet in the future.

LITERATURE.

Magneto and Dynamo Electric Machines: with a Description of Electric Accumulators. A Practical Handbook, translated from the German of Glacer de Cew, by F. Krohn. Second Edition, Enlarged, with a Preface and an additional Chapter on the Latest Types of Machines, by W. B. Esson. London: Whittaker and Co., and Bell and Sons. 1887.

There are few electricians who have not at least heard of Glacer de Cew's book, and we are glad to find that Mr. Krohn's translation of it has reached a second edition. The volume before us is an octavo of 311 pages; at the end is a copious index. These pages are well printed and the paper is good. The volume is abundantly illustrated, but the woodcuts are nearly all old. It seems that in the present day very few authors or publishers will incur the cost of new engravings, and so the same cuts meet us at every turn. The prominent defect of this and all similar text-books in the matter of engravings is that they never contain anything with the aid of which it would be possible to construct a machine; that is to say, it never seems to enter the head of author or publisher that a working-drawing properly dimensioned might prove of value to the reader. The cuts in this book are not well printed, possibly because the blocks or electrotypes have seen too much service; possibly because the publishers would not incur the expense of printing them properly. In this respect, however, the volume is no worse than many others which we could name, and is very much better than some.

The volume contains a history of magneto-electric and dynamo-electric machines, and goes over a great deal of old ground. The historical portion is, however, on the whole well done, and considerable care has been taken to make the principles of each machine clear. All this is contained in an introduction. We have next what is still a history in a sense, namely, a description of all the machines which have at one time or another made their mark.

It is not until we reach the third chapter that we come on what may be termed original matter. This is devoted to a consideration of the peculiar applicability of the various electric generators to various purposes. The author prefers continuous to alternating current machines, and gives his reasons for the preference. He next considers the means—automatic and otherwise—available for regulating current, and subsequently devotes many pages to the consideration of accumulators. We find, however, that he makes no reference to the ingenious and efficient shunt current regulator of Messrs. Goolden and Trotter. In Chapter VI. we have an explanation of the physical laws bearing on the construction of electric machines and their application in practice. All this is very well done, but not better than it has been done by other writers. Chapter VII. is devoted to the construction of the several parts of electric generators. There is here to be found a great deal of information, but it is hardly of a practical kind; and, as we have said before, it would not be of much use to anyone undertaking to build a machine. The employment of electric generators in producing the electric light, the galvano plastic process, telegraphy, &c., is considered in Chapter IX. In the tenth chapter we find formulæ for the construction of electro-magnets. In the eleventh chapter instruments for measuring currents are explained, and in the twelfth chapter we have an account of the latest types of generator.

The book is, on the whole, satisfactory, and we can recommend it to the student. We have often heard it said, "One never can find what he wants in a book." This cannot be said, we think, of the present volume, although, as we have stated, it is different in many respects. Electricians engaged in practical work will find it of some service as a reference volume, especially the latter portion.

It is a noteworthy fact that the theory of two well-known machines has never been satisfactorily explained. One is the Gramme, or Pacinotti armature, concerning which our author gives the commonly-received explanation, which we need scarcely tell our electrical readers is not regarded as complete or satisfactory by all electricians; the other is the Thomson-Houston machine, concerning which our author says:—"This is an arc lighting machine which exhibits in its construction every shade of electrical heresy. Although most of the principles of correct design, or of design hitherto considered correct, have been violated in its construction, it seems, disregarding the question of efficiency, that a high degree of success has attended its working. It is largely employed in the United States, but has only recently been introduced into England." The author does not explain the reason, which is that the machine is used almost exclusively for arc lighting in combination with a very excellent lamp. The lamp and the machine must be taken together, for we believe they have never been worked satisfactorily apart. One of the reasons why the lamp works so well is that the machine has an efficiency of only about 50 per cent.; but the light produced is so clear, steady, and colourless that the public are willing to sacrifice efficiency to obtain so desirable a result. This is the whole secret of the popularity of the generator, which has a very peculiar armature, resembling in its winding that of a ball of string crossed and re-crossed symmetrically. The theory of the machine has long been a *crux* for electricians, and our author says:—"That the action of the machine will ever be completely understood seems highly improbable, from the complicated reactions taking place."

It is worth notice that our author says nothing of the very remarkable dynamos used with the Parsons' steam turbine, of which a large number is running at the Newcastle Exhibition at about 8000 revolutions a minute.

The Practical Engineer's Handbook: Comprising a Treatise on Modern Engines and Boilers, Marine, Locomotive, and Stationary; and containing a large collection of Rules and Practical Data relating to recent Practice in Designing and Constructing all kinds of Engines, Boilers, and other Engineering work; the whole constituting a comprehensive Key to the Board of Trade and other Examinations for Certificates of Competency in Modern Mechanical Engineering. By Walter S. Hutton. London: Crosby Lockwood and Co. 1887.

This book is by the author of the "Works Managers' Handbook," and is of a very comprehensive and ambitious character. Its style is very much that of the handbook, which has been well received, and as it contains a great deal that the works' manager very frequently requires, put in a form that is very easily taken in at a glance; and, moreover, as it contains a great deal of practical experience and gives very numerous rules, unencumbered by purely theoretical minutiæ, the book has deservedly reached a fourth edition. The object of the book now before us is to economise time, and to present to mechanical engineers generally a compendium of theoretical and practical information of the kind most frequently required in the common daily routine of the office and works; and in a cut-and-dry form. In this Mr. Hutton has succeeded completely, as far as the scope of his compilation goes. He has collected together a surprising quantity of rules and practical data, and has shown much judgment in the selections he has made with a view to giving what is wanted in the works, as differing from that which is wanted in the class room. A certain amount of objection always attaches to rules which are not accompanied by reasons and proofs, but there is no doubt that this book is one of the most useful of its kind published, and will be a very popular compendium, the more so as it is illustrated with a large number of useful small engravings of practical value. The author deals very much in rules, and, of course, is prone to accept rules wherever he finds them. To make a really useful collection of rules, however, requires a great deal of care in selection and revision, and it is a waste of space to give several very similar rules for the same thing, as Mr. Hutton does, for instance, concerning condensation of steam, a subject on which he gives four rules, separated by other rules for no apparent reason, and introduced with the remark that the following rule or formula "is sometimes used," but no reason is given for "sometimes" using the one instead of the other. This plan of piling up rules and, as it were, saying, "Yer pays yer money and yer takes yer choice," might be rather embarassing to the young engineer, who finds the four rules giving for the same thing four different results, namely, 20, 21, 21·57, and 22·22. With a very little examination Mr. Hutton might have seen that one rule could have replaced the four.

For the quantity of coal a ship's bunker will contain a rule is given, which refers to rectangular bunkers, but the sketch given shows a bunker whose capacity would be much less than the rule gives because of its curved form. The author's division of his subjects is very mixed. For instance, a distinct isolated paragraph upon the weight of steam is placed under a general head on combustion and consumption of fuel in steam boiler furnaces, though there are parts dealing specially with steam. There is, however, a very good index, which is palliative of this sort of thing. In a chapter on evaporation the efficiency of a steam generator is given as $E = \frac{T_1 - T_2}{T_1 + 461}$. Why the 461 is put into the divisor and denied to the numerator is not clear, and absolute temperature is not mentioned. Some confusion on a similar subject occurs on another page concerning the efficiency of the steam engine. Here the author gives T_1 as the absolute initial temperature, so that his formula as above would give a curious result, and the wavering engineer would be hopelessly uncertain if he looked at the opposite page and found the theoretical efficiency arrived at without any reference to absolute temperature. Concerning the strength of boiler shells a large number of rules is given, but rules or formulæ by which the engineer may find the stresses for himself, and apportion sections according to circumstances, are not given.

The power obtainable by using a condenser "may be easily calculated," the author says. He simply assumes that the condenser back pressure is 3 lb., and that the power of an engine is increased by 12 lb. per square inch extra pressure. How nice it would be if the non-condensing compound engines now working with 1·6 lb. could be made to work with 1·4 lb. per indicated horse-power by putting on a condenser.

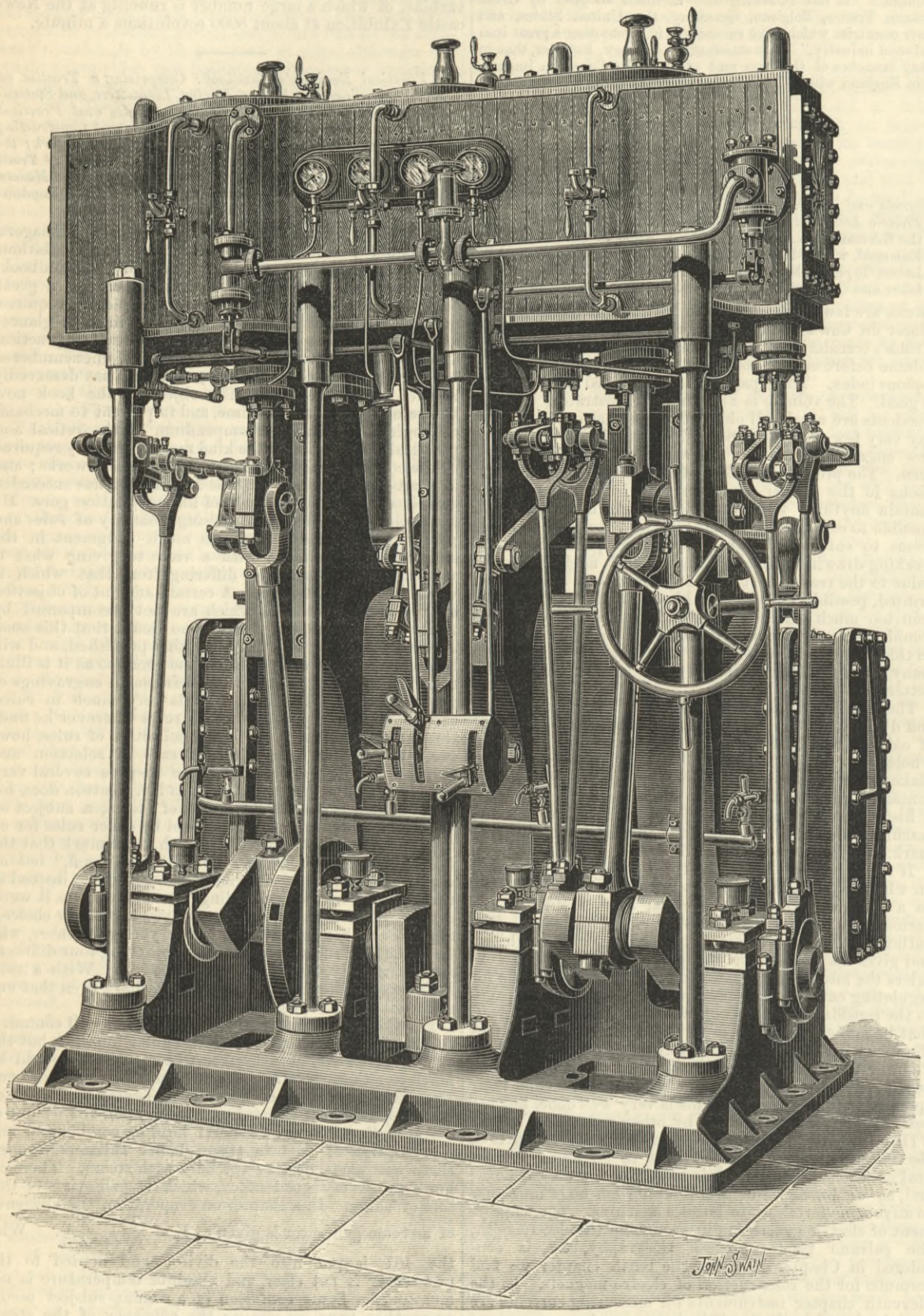
Cost of Transmission of Power.—The following table has been published as showing the relative cost of transmission of 100-H.P. to given distances by four different systems.

Systems Employed.	330ft.	1640ft.	3280ft.	16,400ft.	32,810ft.	65,620ft.	Motor.
	d.	d.	d.	d.	d.	d.	
Electricity	1·80	1·84	1·94	2·27	2·84	4·61	Steam.
Water-pressure ..	2·27	2·36	2·61	4·03	5·79	9·57	
Compressed air ..	3·17	3·23	3·33	4·05	5·25	6·39	
Ropes	1·26	1·49	1·58	2·88	4·29	12·68	
Electricity	0·46	0·48	0·53	0·62	0·68	1·15	Hydraulic.
Water-pressure ..	0·46	0·55	0·62	1·33	2·23	3·54	
Compressed air ..	0·72	0·80	0·84	1·21	1·86	3·36	
Ropes	0·25	0·27	0·30	0·80	1·42	3·39	

It need hardly be said that the cost of transmission by electricity is an estimated cost, there being very little experience on the subject.

TRIPLE-COMPOUND MARINE ENGINES.

MESSRS. ALEXANDER SHANKS AND SONS, ARBROATH, ENGINEERS.



TRIPLE EXPANSION MARINE ENGINES.

We illustrate above a set of triple expansion marine engines made by Messrs. Alexander Shanks and Son for a working pressure of 150 lb. per square inch. The following is the specification to which the engines were built:—

Cylinders.—To be three in number, one for high, one for medium, and one for low-pressure steam. The high-pressure cylinder to be 10in. diameter, the intermediate cylinder to be 15in. diameter, and the low-pressure cylinder to be 24in. in diameter, all having a clear stroke of 18in. To be of a special mixture of hard grey cast iron, to be perfectly sound and truly bored, to have escape valves at top and bottom so arranged as to prevent accidents to anyone. These and all other valves to be kept outside the lagging, so that they may be easily examined and kept tight. Drain cocks to be fitted into all cylinders, with drip pipes attached for leading the condensed water into the bilges or condenser, and a complete set of indicator gear to be attached to all cylinders. The cylinders to be lagged with hair felt and covered with polished mahogany.

Pistons.—To be of the same metal as the cylinders, cast hollow with strong connecting ribs, each to have two metallic packing rings.

Cylinder covers.—To be of strong cast iron, with strengthening ribs on the top sides, and polished on their edges and faces; the recesses to be lagged with hair felt and covered with polished mahogany.

Starting valve.—To be on the slide principle, single ported and partially balanced; to be fitted on the low-pressure cylinder, and the lever for operating the valve to be brought within easy reach of the reversing wheel.

Slide valves.—To be of the ordinary class, and of the same metal as cylinder; the high-pressure and the intermediate pressure valves to be single ported, the low-pressure valve double ported.

Steam chest doors.—To be of strong cast iron, strengthened by ribs, lagged with hair felt, and covered with polished mahogany.

Bed plate.—To be of box form, having four bearings. The crank-shaft bushes to have round bottoms, and to be held in their places by wrought iron covers and through-bolts and nuts.

Surface condenser.—To form part of the standards at the back of the engine, and to be fitted with horizontal brass tubes $\frac{3}{4}$in. external diameter and No. 19 b.w.g. in thickness, and arranged for the circulating water to pass through them, the steam being condensed on the outside. The tube plates to be of Muntz metal $\frac{3}{4}$in. thick. The tubes to be fixed by wooden ferrules, and to have a total cooling surface of 365 square feet.

Air pump.—To be single-acting, and worked from sway levers connected to the intermediate piston-rod crosshead. The pump barrel to be of gun-metal, $\frac{3}{8}$in. thick, and to be 12in. diameter, with a stroke of 9in.; the bucket, valve seats, guards, and all bolts and studs which come into contact with the water to be of gun-metal. The pump-rod to be of gun-metal. All valves to be placed as near their work as possible.

Circulating pump.—To be double-acting, and operated in the same manner as the air pump. The pump barrel to be of gun-metal $\frac{5}{16}$in. thick and 8in. diameter, with a stroke of 9in. The bucket, valve seats, guards, &c., to be of brass, and all necessary shifting and other valves to be provided.

Feed pumps.—There will be one feed pump, single-acting, and $2\frac{1}{2}$in. diameter, worked from the air pump crosshead. The plungers, valves, and valve seats all to be of brass, and provided with escape valve and cast iron air vessel.

Bilge pumps.—To be one in number, and similar to feed pump.

Standards.—Back standards for supporting cylinders to be of box form, cast along with condenser, of good clean cast iron. Those in front of the engines to be of wrought iron, four in number, $2\frac{3}{8}$in. diameter. The back columns to be provided with loose cast iron guides to suit the crosshead slippers.

Brass bushes.—All brasses throughout the engines to be of the very best gun-metal.

Piston-rods.—To be of hammered steel, $2\frac{3}{8}$in. diameter, and fixed to the pistons by taper ends and nuts on top side of pistons. The crossheads to be forged solid with the piston-rods, and to be provided with gun-metal slippers 12in. long and $6\frac{1}{2}$in. wide.

Connecting-rods.—To be of the best hammered scrap iron 3ft. 9in. long from centre to centre, and $2\frac{1}{2}$in. diameter at the smallest part and tapered from end to end. The forked ends to be provided with steel crosshead pins securely shrunk into the eyes, and the bottom ends to be provided with gun-metal bushes.

Link motion.—Slide valves to be worked by link motion, having cast iron excentric pulleys, gun-metal straps, wrought iron rods and links, and valve spindles of steel. The valve spindles to have guides at top. The top end of excentric rods, eyes of valve spindles, and sliding blocks all to be provided with gun-metal bearings having suitable provision for adjustment. The distance from centre to centre of excentric-rods at the links to be 9in. The latter to be provided with double drag-links, those for the high-pressure valve to have screws and nuts to enable the cut-off to be changed in high-pressure cylinders; the reversing gear to be worked by a hand-wheel and double-threaded screw.

Crank shaft.—To be of best hammered scrap iron or steel as required, $4\frac{3}{4}$in. diameter in the journals, and to be composed of one solid forging, and to be perfectly true. The three cranks to be at angles to one another of 120 deg.

Water service.—To be fitted on crank shaft and crank-pins. All the connections to be of gun-metal, and all the pipes of copper.

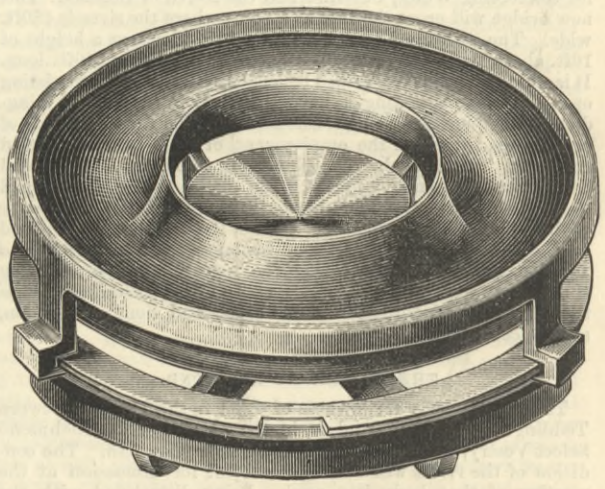
Throttle valve.—To be of the equilibrium double-beat description, with all necessary levers to bring it within easy reach of the reversing-wheel.

Lubricators.—A complete set of lubricators, oil-boxes, oil-cups, and all necessary pipes and syphons to be provided. The oil-cups on the crank shaft to be placed above the bearing.

Hand-turning gear.—To consist of a cast iron disc with suitable hand-lever.

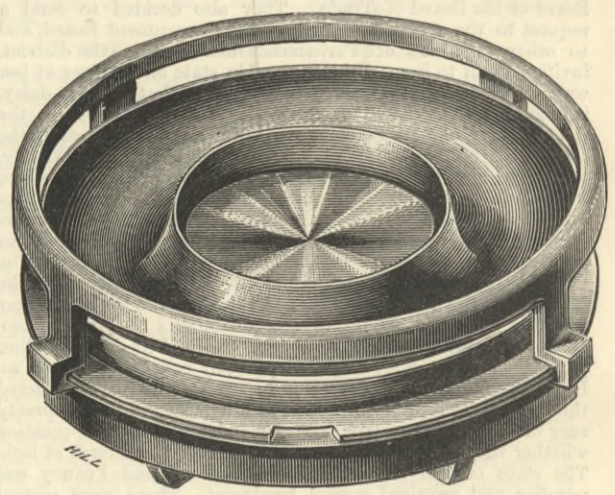
LOCKWOOD'S SPINDLELESS METALLIC VALVE.

The accompanying engravings illustrate a new valve for use with marine and other engines, patented by Mr. Lockwood, and



VALVE OPEN.

now being introduced for general application. The above engraving shows the valve open. The valve proper consists of a cupped ring, the inner and outer edges of which bear on a



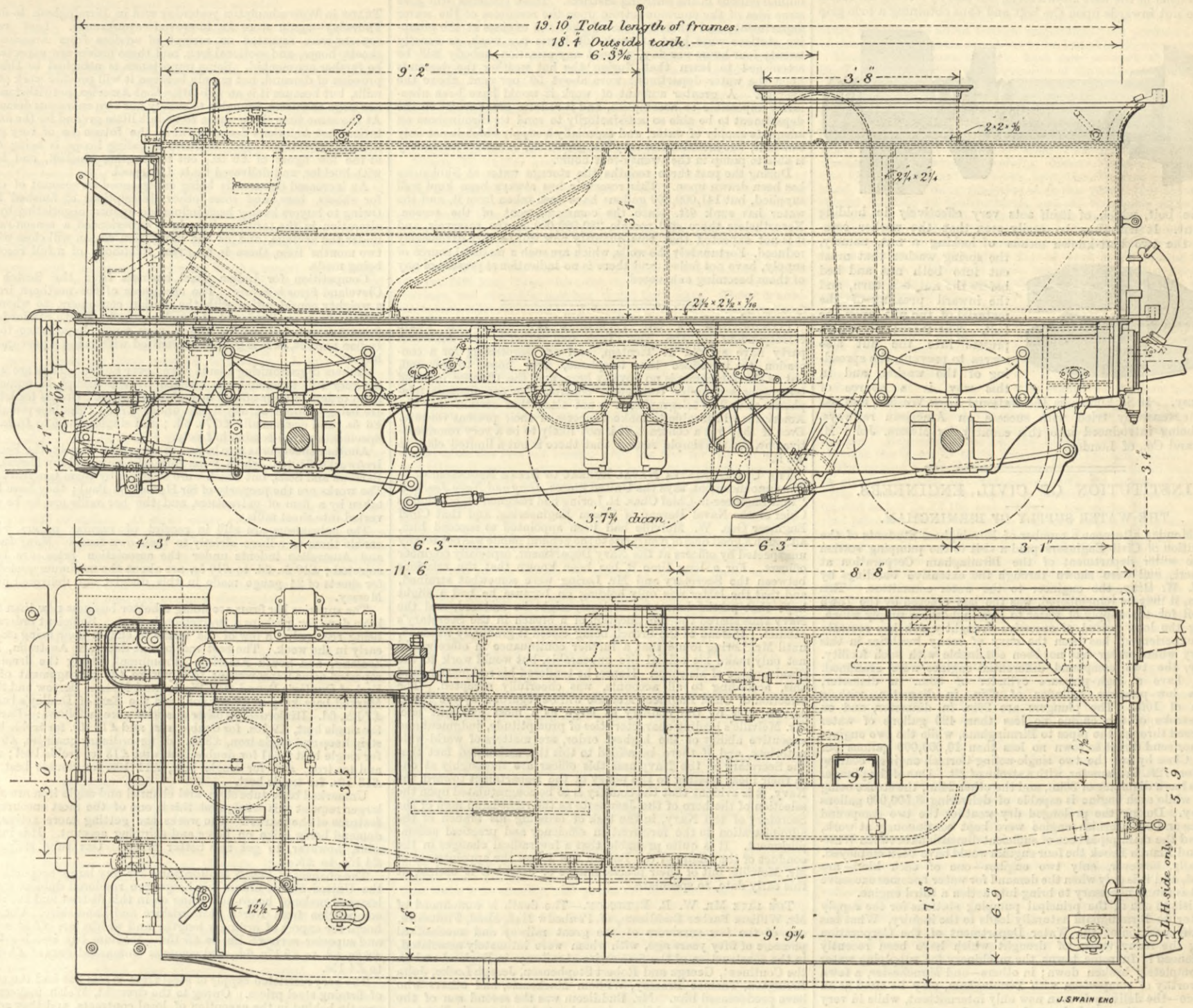
VALVE SHUT.

faced seat; outside is a cage which holds the valve in place. It has, of course, a very large delivery for a small lift; one set has been in operation at the Birkenhead Waterworks for twelve months, giving perfect satisfaction.

College of Agriculture, Downton, Salisbury.—The summer session closed on Saturday, the harvest having been completed a week previously. The subjects of examination included agriculture, dairy farming, agricultural and general chemistry, botany and plant physiology, entomology, mensuration, land surveying and building construction. Practical competitions took place in ploughing, harnessing and driving, knowledge of live stock, milking, butter making, farm machinery, and chemical analysis. The natural history competitions included collections of grasses, of weeds of arable land, of forest specimens, of insects, &c. The following were the awards:—Certificate of proficiency in practical agriculture, obtainable on examination, after completion of two years' course of study, to Mr. O. B. Rickards, Whalley Range, Manchester, and to Mr. A. E. Seawell, B.A., Seale Lodge, Farnham, Surrey. Prizes were obtained by Mr. G. E. Antrobus, Eaton Hall, Congleton; Mr. A. W. C. Bower, Broxholme, Scarborough; Mr. P. C. Burton, Mount Park-crescent, Ealing; Mr. D. W. Collyer, Craig Nethan, Weston-super-Mare; Mr. C. E. M. Deaborough, Headington, Oxford; Mr. J. B. Feilding, Stapleton Rectory, Shrewsbury; Mr. V. S. Galsworthy, 11, Waterloo-place, Pall Mall; Mr. C. E. Mackenzie, Charborough Park, Wareham; Mr. T. P. Pochin, Braunston House, Leicester; Mr. G. P. Smithson, Morris Grange, Richmond, Yorks; Mr. E. A. Sweatenham, Lampton Lodge, Isleworth; Mr. F. D. Solomon, Southfield House, Dartford; Mr. E. H. Thompson, Highbury, Bournemouth; Mr. F. B. Thresher, Corfe Hill, Weymouth; Mr. W. A. Watson, B.A., 65, Eccleston-square, S.W.; Mr. A. H. Wrightson and Mr. R. G. Wrightson, 7, Herne-terrace, Worthing.

MANCHESTER EXHIBITION.—PASSENGER ENGINE, LANCASHIRE AND YORKSHIRE RAILWAY.

THE VULCAN FOUNDRY COMPANY NEWTON LE-WILLOWS, ENGINEERS.



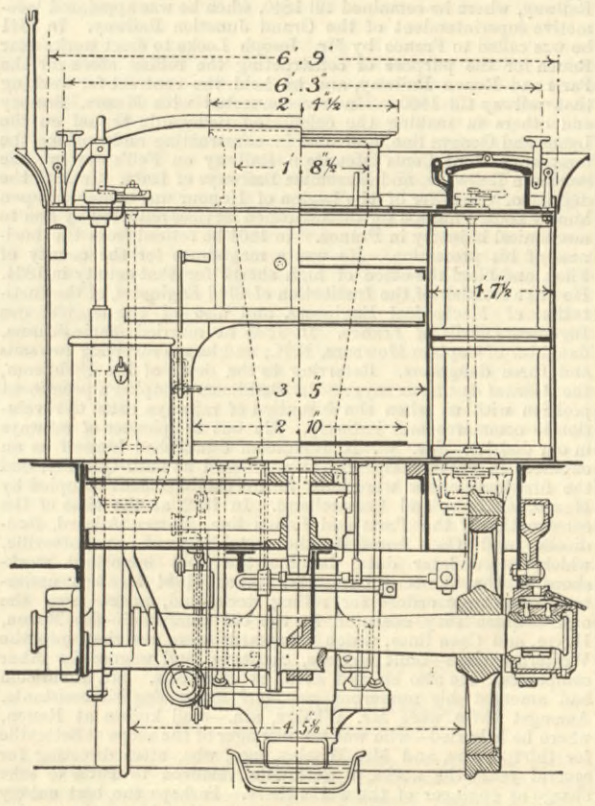
PASSENGER ENGINE, LANCASHIRE AND YORKSHIRE RAILWAY.

On page 174 will be found a longitudinal section of the fine bogie passenger engine exhibited at Manchester by the Lancashire and Yorkshire Railway Company. This is one of a number built by the Vulcan Foundry Company for the Railway Company, and although the designs for the present engine have been got out under Mr. Aspinall's superintendence, the general features of the engine are identical with those designed by Mr. Aspinall's predecessor, Mr. Barton Wright. In fact, care has been taken to make, as far as possible, all the working parts the same, so that the engines shall duplicate each other. The only difference of importance is that the bogie has been made of the swinging type, not much used hitherto in England, and the engine frames, instead of being bent to clear the bogie, are straight from end to end.

The annexed tabular statement gives full particulars of the engine and tender, and engraving of which will be found above.

Particulars of Lancashire and Yorkshire Express Bogie Passenger Engines and Tenders, built by the Vulcan Foundry Company.

	ft.	in.
Boiler—		
Diameter of boiler outside at fire-box end	4	4
Length of barrel	10	3
Thickness of plates, best Yorkshire iron	0	0½
Fire-box shell—		
Length outside	6	0
Breadth outside at bottom	4	1
Depth from centre line at front and back	4	8
Copper fire-box—		
Length of copper fire-box inside, top	5	0⅜
Length of copper fire-box inside, bottom	5	4⅜
Breadth of copper fire-box inside, top	3	8
Breadth of copper fire-box inside, bottom	3	6
Tubes—		
Material, iron; number, 192.		
Diameter outside	0	1⅜
Length between tube plates	10	7⅝
Heating surface—	sq. ft.	
Fire-box	95·5	
Tubes	935·4	
Grate area	18·75	
Cylinders, in one casting—	ft.	in.
Inside diameter of cylinders	1	5½
Stroke of piston	2	2
Length of ports	1	3
Width of steam ports	0	1¼
Width of exhaust port	0	2⅜
Centre to centre of cylinders	2	4
Centre to centre of valve spindles	0	3¾
Inclination of cylinders	1 in 12	
Excentrics—		
Throw	0	6¼
Diameter	1	4
Rods—		
Length of excentric-rods	4	10
Length of connecting-rod	5	10
Wheels, mild Siemens steel—		
Diameter of coupled wheels on tread	6	0
Diameter of bogie wheels on tread	3	0½
Thickness of tires when finished	0	3
Width of tires when finished	0	5½
Wheel base—		
From centre to centre of bogie axles	5	6
From centre of bogie to driving axle	9	10
From centre of driving to trailing axle	8	11
Total wheel base	21	6
Axles, Siemens steel—		
Bogie axle: Diameter of journal	0	5½
„ Length of journal	0	9½



Driving axle:	Diameter of connecting-rod journal	0	7½
„	Length of connecting-rod journal	0	4
„	Diameter of axle-box journal	0	7½
„	Length of axle-box journal	0	7
Trailing axle:	Diameter of axle-box journal	0	7½
„	Length of axle-box journal	0	7
Coupling-rods, mild Siemens steel—			
Length of coupling-rod C to C		8	11
Diameter of coupling-rod journal		0	4
Length of coupling-rod journal		0	4⅜

Driving and trailing axle-boxes—
Wrought iron, case-hardened, and fitted with gun-metal bearings.

Bogie—
Bogie, swing link type.
Bogie frames mounted on eight springs.

Injectors—
Two self-acting re-starting injectors.
Clack-boxes with combined injector and ejector steam valve.

Brake—
The engine and tender are fitted with the automatic vacuum brake.

Weight of engine, empty—	tons.	cwt.	qr.
Bogie wheels	11	15	0
Driving wheels	13	17	0
Trailing wheels	12	2	0
Total	37	14	0
Weight of engine, working order—			
Bogie wheels	12	9	0
Driving wheels	15	13	0
Trailing wheels	13	15	0
Total	41	17	0

TENDER.

Tank, 2000 gallons—
Fitted with Ramsbottom's arrangement for picking up water.

Axles, mild Siemens steel—	ft.	in.
Diameter of journal	0	4½
Length of journal	0	9
Centre to centre of journals	6	3

Axle-boxes—
Cast iron, fitted with gun-metal bearings.

Wheels, mild Siemens steel—		
Diameter of wheel on tread	3	7¾
Thickness of tires when finished	0	3
Breadth of tires when finished	0	5½

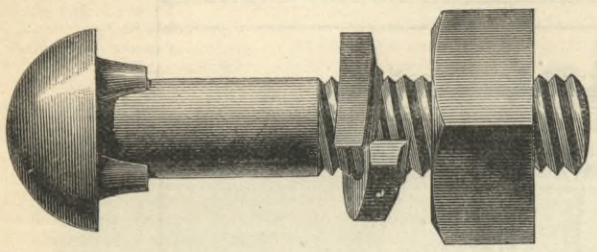
Springs—		
Length of leading and trailing spring C to C, unloaded	2	8½
Camber of leading and trailing spring C to C, unloaded	0	4½
Breadth of leading and trailing spring C to C, unloaded	0	3½
Thickness, top plate, ½in.; 14 plates, ⅜in.		
Length of centre spring C to C, unloaded	3	2½
Camber of centre spring C to C, unloaded	0	4½
Breadth of centre spring C to C, unloaded	0	3½
Thickness, top plate, ½in.; 16 plates, ⅜in.		

Weight of tender, empty—	tons	cwt.	qr.
Front	5	4	0
Middle	6	6	0
Hind	4	14	0
Total	16	4	0
Weight of tender, with tanks full and 40 cwt. of coal—			
Front	8	14	0
Middle	9	8	0
Hind	8	13	0
Total	26	15	0

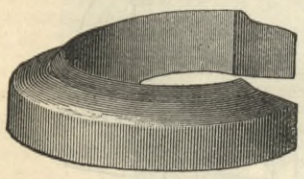
Telephone service between Hamburg and Berlin—a distance of 150 miles—has now been opened to the public.

NEW LOCK WASHER.

The spring lock washer illustrated by the accompanying engravings is made of novel section of steel, and acts not only as a spring-lock washer of the well-known form, but also by forcing the metal of the nut inwards upon the bolt and thus obtaining a firm grip



of the bolt, which of itself acts very effectively in holding the nut. It will thus be easily seen that the washer combines the two best-known means of locking a nut, namely, the spring washer that must cut into both nut and bed before the nut can turn, and the inward pressing of the material of the nut upon the bolt. The raised rib which presses into the nut also serves to prevent the spreading of the washer, and in this way is a source of economy. It is known as the National Lock Washer, and has been extensively tried with success on American railways. It is being introduced into this country by Messrs. John H. Ladd and Co., of London.



INSTITUTION OF CIVIL ENGINEERS.

THE WATER SUPPLY OF BIRMINGHAM.

On Monday afternoon a number of Birmingham Students of the Institution of Civil Engineers paid a visit to the pumping station of the water department of the Birmingham Corporation at Whitacre, and were shown through the extensive buildings by Mr. J. W. Gray, the engineer to the water committee. This station, it may be remembered, was the last erected by the Town Council for the supply of water to Birmingham—a supply which, during the long period of excessive drought which has recently been experienced, has been the envy of many localities in this country where water has not been obtainable with such facility. Firstly, the two compound differential engines were examined. These have a high-pressure cylinder of 33in. in diameter, and a low-pressure cylinder of 60in. in diameter, with a stroke of 10ft. The plungers are 26in. in diameter, and on each stroke of the engine no less than 420 gallons of water are forced through the pipes to Birmingham, while the two engines together send direct to town no less than 10,000,000 gallons per day. Close by are the two single-acting Cornish engines, bearing cylinders 72ft. in diameter, with a stroke of 2ft. One of the plunger pumps has a diameter of 30in., and the other 24in., the stroke being 10ft.; while each engine is capable of delivering 3,500,000 gallons per day. During the prolonged dry weather the two compound engines and one Cornish engine were kept continuously at work, and had the main pipes been of sufficient dimensions between Whitacre and Plant's Brook the four engines would have been employed. Normally, however, only two engines—one of each kind—are worked, and it is only when the demand for water becomes excessive that it is found necessary to bring into action a third engine.

A visit to one of the principal pumping stations for the supply of water to Birmingham naturally leads to the inquiry, What has been the position of the Water Department of the Corporation during the many weeks of drought which have been recently experienced? In some towns the machinery for supplying water has completely broken down; in others—and Manchester, a town well worthy of comparison with Birmingham, may be cited as an instance—the delivery is even now only intermittent, while in very few places has the supply been of such a character as not to cause uneasiness. In Birmingham, the *Birmingham Daily Post* says, the Water Department has not been alarmed to any great extent. Their resources certainly were taxed to the utmost, but thanks to the prudence and forethought of the committee and their officers, the town has passed through the long period of drought without any extreme anxiety, and with the consciousness that a constant supply of pure water could still be given to the town even though the dry weather continued for several weeks to come. The difficulties of providing for an exceptionally increased demand were satisfactorily overcome, even when the effects of the drought were the most severely felt. The greatest quantity of water ever supplied to Birmingham in a single week was 146,000,000 gallons during the week ended the 1st July last. From the station at Plant's Brook were pumped 13,936,090 gallons; from Whitacre, 61,096,220 gallons; and from the well at Whitton, 6,711,250. The quantity of water pumped to the low-level district that week, therefore, was 81,743,560 gallons. From that quantity however, must be deducted 23,852,730 gallons, which was transferred to the supply of the middle-level district from Monument-lane to Aston, thus giving a supply to the low-level district of 57,890,830 gallons. The pumping station at Aston receives water from the Perry Brook, the Witton Brook, the Perry well, and the King's Vale well; and from that station 82,566,998 gallons were pumped to the middle-level district. But of that quantity 10,383,010 gallons were utilised for the high-level or Monument-lane district, so that the middle-level district consumed 72,183,988 gallons. To that 10,383,010 gallons must be added 5,937,490 gallons, which were taken from the Solly Oak well, and the total quantity of 16,320,500 gallons was consumed by the Edgbaston district, which includes Edgbaston, Moseley, and the upper part of Handsworth above the Soho-road. The water supplied to those three districts consequently gave a total quantity of 146,395,318 gallons. This vast quantity of water was obtained from rivers and wells, and it is interesting to know how much of the water consumed that week was derived from the different sources. In the low level district, out of the 57,000,000 gallons, 5,035,938 gallons were obtained from wells, and 52,854,892 gallons from rivers. To the middle district was supplied 29,008,711 gallons of well water and 43,175,277 gallons of river water; and to the high-level district was supplied 10,081,591 gallons of well water and 6,238,909 gallons of river water. From these figures it will be seen that the proportion of well water to river water supplied in the low level district was about one-eleventh, while rather more than one-half—about five-eighths—of the water supplied to the middle level district was well water, and about three-fourths of that supplied to the Edgbaston district was also taken from wells. During the first half of the present year the quantity of water pumped into Birmingham was 2,497,985,852 gallons, as compared with 2,246,243,837 gallons in the corresponding half of last year, or an increase this year of 251,742,015 gallons. Subdividing the figures again, it appears that the quantity of water supplied for all purposes, such as domestic and trade uses, street watering, &c., during the maximum week per head of the population per day was 41½ gallons, and that was during the last week of the half-year. Omitting the four weeks of July, when the drought was the most severely felt, it seems that the average number of gallons consumed per head per day was only 26¼, while the average for the whole half-year was 27½ gallons. During the dry weather there were many complaints among the inhabitants concerning the dusty nature of the streets, and yet upwards of four million gallons per week were utilised for street watering in the borough, and one and a-half million gallons in the outlying districts. These statistics will give some idea of the enormous strain upon the resources of the water department; and when it is stated that the engines at the pumping stations were kept at work 168 hours per week, or exactly twenty-four hours per day, without any cessation, nobody will be astonished to learn that during the hot weather the demands upon the water department were about 50 per cent. above the average. A greater amount of work it would have been absolutely impossible to accomplish, and it reflects great credit on the department to be able so satisfactorily to send to Birmingham an adequate supply of water, and especially a supply which is not only constant, but includes the very last gallon the extensive machinery is able to pump in the twenty-four hours.

During the past three months the storage water at Shukstoke has been drawn upon. This reservoir has always been kept well supplied, but 141,000,000 gallons have been taken from it, and the water has sunk 6ft. since the commencement of the season. Nevertheless there still remain 280,000,000 in the reservoir, and it is not expected that this quantity now will be very extensively reduced. Fortunately the wells, which are such a material source of supply, have not failed, and there is no indication at present of any of them becoming exhausted.

Introduction of the Telephone into China.—A Pekin correspondent of the New York *Sun* says:—"An American party have arrived at Tientsin, and are negotiating for a concession to introduce the telephone, and hope to succeed, but as the telephone is no novelty here, and the Chinese imperial telegraphs are under competent control, who can manage telephones as well as telegraphs, it is not altogether certain that the Americans will be able to make a success of their present venture. Even if they get a contract, it is not likely to be a very remunerative one, for the simple reason that there is but a limited class to use it."

The United States Naval Bureau of Steam Engineering.—The announcement, says the United States *Army and Navy Journal*, "that Engineer-in-Chief Chas. H. Loring had resigned his position as Chief of the Naval Bureau of Steam Engineering, and that Chief Engineer Geo. W. Melville had been appointed to succeed him, although a good deal of a surprise to the general public was not totally unexpected by officers at the Navy Department, especially engineer officers. For a long time it has been known that the relations between the Secretary and Mr. Loring were somewhat strained, and that the latter was only holding on because he had a slight hope that partial harmony, at least, might be restored, and the Navy thus spared the mortification of a breach in the Secretary's cabinet. Instead of the breach being closed it gradually widened, until Mr. Loring found that a further continuance in office would not only make his official life unbearable, but would work to the disadvantage of his corps. Hence, he tendered his resignation, and this, according to all accounts, was cheerfully accepted. The selection of Chief Engineer Melville will be regarded by the Naval service and by the country at large as a most excellent one. Mr. Melville's leading characteristics of promptitude, judgment and executive ability of the highest order, are matters of world-wide notoriety, and if there be added to this the undoubted fact that the Secretary of the Navy and this officer are thoroughly at one in their ideas relating to the policy of the Department toward the Navy, it is evident that the country is to be congratulated upon the selection of the hero of the Jeannette as the right-hand man of the Secretary of the Navy, in the task of bringing his branch of the administration to the forefront in efficiency and practical accomplishment. It is quite probable that a few radical changes in the conduct of the affairs of the Bureau will follow the appointment of Mr. Melville, but of their precise nature or extent it is useless, at this early date, to speculate."

The late Mr. W. B. Buddicom.—The death is announced of Mr. William Barber Buddicom, of Penbedw Hall, Mold, Flintshire, one of the few survivors of the great railway and mechanical pioneers of fifty years ago, with whom were intimately associated, in the construction of the first series of railways in England and on the Continent, George and Robert Stephenson, Joseph Locke, John Errington, Thomas Brassey, William Mackenzie, and others who have predeceased him. Mr. Buddicom was the second son of the Rev. Robert Pedder Buddicom, incumbent of St. George's, Everton, and afterwards principal of St. Bees College, and was born at Liverpool in 1816. He was apprenticed at an early age to the engineering firm of Mather, Dixon, and Co., of Liverpool. In 1836, at the age of 20, he was appointed resident engineer on the Manchester and Liverpool Railway, and during the time he was so employed carried out many important works. In 1838 he was appointed engineer on the joint Glasgow, Greenock, and Paisley Railway, where he remained till 1840, when he was appointed locomotive superintendent of the Grand Junction Railway. In 1841 he was called to France by Mr. Joseph Locke to erect works near Rouen for the purpose of constructing the rolling stock for the Paris and Rouen Railway, and he held the contract for working that railway till 1860. He was connected with Messrs. Brassey and others in making the celebrated Bellegarde tunnel on the Lyons and Geneva line, and also in constructing and working the temporary Mont Cenis Mountain Railway on Fell's system, the Southern Railways, and Maremma Railways of Italy. In 1847 the dignity of Chevalier of the Legion of Honour was conferred upon him by Louis Philippe for distinguished services rendered by him to mechanical industry in France. In 1864 he retired from the business of his profession. He was a magistrate for the county of Flint, and filled the office of high sheriff for that county in 1864. He was a member of the Institution of Civil Engineers, of the Institution of Mechanical Engineers, and also of the Société des Ingénieurs Civils of France. In 1845 he married Marie Jeanne, daughter of Captain Hownam, R.N., and leaves surviving two sons and three daughters. Referring to the death of Mr. Buddicom, the *Journal de Rouen* says:—Mr. Buddicom occupied a prominent position with us when the invention of railways came to revolutionise commerce and industry. He was the pioneer of railways in our district. Mr. W. B. Buddicom established himself as an engineer in partnership with Mr. Allcard at Petit-Quevilly, and the first locomotives were built in the establishment occupied by Messrs. Corbran and Lemarchand. In 1842, at the time of the construction of the Paris and Rouen line, Messrs. Allcard, Buddicom, and Co. founded the establishment at Sotteville, which, at a later date, became the most important workshops of the Western Company. About 1854 his firm undertook very large orders for rolling stock, and, apart from the orders which they executed for the old companies—the Rouen, Havre, and Caen lines, which afterwards were absorbed into the Western system—built engines, carriages, and wagons for other companies. He also started shops at Bordeaux. Mr. Buddicom had amongst his numerous *personnel* many English assistants. Amongst these were Mr. Whaley, sen.—well known at Rouen, where he is buried—who was the manager of the shops at Sotteville for thirty years, and Mr. Whaley, jun., who, after directing for several years the works at Sotteville, removed to Paris to take charge as engineer of the works there. Perhaps the best eulogy that can be paid to an engineer is to say that his works survive him. There are still on the French railways—particularly on the Rouen to Elbeuf-Saint-Aubin lines—some locomotives of the "Buddicom type." It is principally to the establishments founded by this eminent engineer that the Commune of Sotteville owes its present importance, and the municipality in recognition of this fact has given the name of "Buddicom" to the street in which the principal entrance to the shops is situated.

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

(*From our own Correspondent.*)

Trade in Wolverhampton yesterday and in Birmingham to-day—Thursday—again wore an improved appearance. Last week's reports were repeated on receipt of advices from America for sheets, hoops, and sectional iron, and these orders are expected to be further augmented. Some importance is attached to this expression of demand, not merely because it will provide work at the mills, but because it is an indication that America, notwithstanding her large resources, is unable to satisfy her own enormous demands. At the same time there seems to be but little ground for the expectation that America's demand will in the future be of very great account for this district. Business in baling hoops is being done at the low figure of £6 5s., cut to lengths, blocked, and fitted with buckles, and delivered f.o.b. Liverpool.

An increased demand is being experienced on account of canal for sheets, bars, and some other descriptions of finished iron. Owing to buyers having been influenced against negotiating by the alteration in the tariff, makers have experienced a season rather under the average, and as the navigation season will close within two months' time, there is no great likelihood of a full recovery being made.

Competition for Indian sheet business from the Scotch and Cleveland firms is severe. The cheapness of the northern iron is a weighty consideration with the Indian consumers, to whom an inferiority in quality is not of much account. South Staffordshire firms are not inclined to attach very much importance to the Indian market, as it is generally credited with being a poor-quality buyer.

Makers of galvanising sheets were never busier. They are working very full time, and are assisted by the receipt of numerous fresh orders in their efforts to maintain prices. Orders for lattens are being refused at any figure under £7 5s.; doubles remain at £6 5s., and occasionally £6 7s. 6d.; and singles at £6 to £6 2s. 6d. Specifications are coming in freely.

Another sheetworks is to be put in operation, namely, the Factory Ironworks, Tipton, which were formerly occupied by Messrs. W. Barrows and Sons, but which were stopped by them ten years ago. The works are the property of Sir Horace St. Paul; they have been taken by a firm of galvanisers, and the bar mills are to be converted into sheet mills.

The galvanisers are still in receipt of regular orders, which enable them to adhere strictly to their own terms. Many Indian and Australian indents under the association price are being rejected; £10 2s. 6d. to £10 5s. are about the minimum quotations for sheets of 24 gauge made in this district and delivered in the Mersey.

The superior bar firms are doing a better business now than they have done for perhaps a twelvemonth past. Sufficient orders are being received at a few of the works to enable their being started early in the week. The best markets at date are Australia, New Zealand, and South America. Prominent among the firms who reported some improvement to-day were the management of the Earl of Dudley's Round Oak Works and Messrs. Barrow and Sons. Marked bars keep at £7 per ton, and the Earl of Dudley's bars at £7 12s. 6d. His lordship's other qualities were as follows:—Bars, £9 for single best, £9 10s. for double best, and £12 10s. for treble best; strip hoop and angle iron, £8 2s. 6d. for ordinary qualities, £9 10s. for single best; £11 for double best, and £13 for treble best; rivet and tee iron, £10 for single best, £11 10s. for double best, and £13 10s. for treble best.

Unmarked bars, tube strip, and channel and angle iron are all in larger request this week, and this is one of the most encouraging features of the market. The works are getting more active, the demand being alike on home and shipping account. It is impossible, however, to get any better prices. Gas tube strips are £4 15s. to £5.

The chances of South Staffordshire for any large proportion of the United States orders for hoops are rendered dubious by the lessened make of hoops now going on in this district and the sharp competition from North Staffordshire and Lancashire. Common hoops for export of ordinary lengths and widths are £5 at works, and superior sorts £5 10s. to £5 15s. Medium bar iron is sold at £6 2s. 6d. to £5 17s. 6d., and common unmarked bars at £5 down to £4 15s.

The very restricted supply of steel from Wales has had the effect of firming steel prices. Owing to the drought, Welsh makers are greatly behind in the execution of local contracts, and they advise that they are unable to accept new business. The effect upon steel consumers is marked.

In the pig iron trade the output is going away from the furnaces with steadiness, and makers report that stocks are decreasing. The demand, however, does not justify the blowing in of more furnaces, particularly as native makers have to meet the competition of outside districts. Midland pigs are about 37s. for Derbyshires delivered to consumers' works; 36s. for Northamptons; and 39s. 6d. to 40s. for Lincolnshires. Where this—Thursday—afternoon quotations were higher no business could be secured. Staffordshire all-mine hot blast pigs keep at 50s. to 52s. 6d.; cold blast at 75s.; part-mines at about 40s.; and cinder pigs at 29s. to 30s., on the open market, with occasional sales taking place at 60s. money.

Hematites are stronger at 53s. to 55s. for forge numbers from the West Coast, and other sorts in proportion.

Some attempt is being made to push sales upon this market of Scotch and Cleveland iron, in which there is at present but little business. Messrs. James Watson and Co., of Glasgow and Middlesbrough, who are the largest holders of pig iron in the world, are soliciting more business from this part of the kingdom, and Mr. W. Hipkins, of Wolverhampton, has just been appointed their representative. The sale will also be made by Messrs. Watson of steel bars and plates, and other descriptions of steel.

The present position of the Patent Shaft and Axletree Co. (Limited), Wednesbury, in the matter of steel manufactures, is sketched in the annual report of the directors just issued. In this they state that the experience of the last twelve months, though not financially satisfactory, seems to have justified the Board in putting down special plant in anticipation of the substitution of steel for iron in nearly all structural work. £32,827 has already been spent in this direction, in addition to upwards of £8000 previously written off, and it is probable that £12,000 to £15,000 more will be required to complete the conversion of the works into one of the most efficient engineering concerns in the country. With regard to the general capital outlay, the directors think that the time has almost arrived when a revaluation of the works and the plant, including all the new erections, should be made; and they propose to put this in hand as soon as the new steel works are finished. The orders taken within the last two or three months for engineering requisites will be sufficient to keep the works well employed, at fairly remunerative prices, for the next six or eight months; and now that the steel plant is in full working order, the output in that department can be more than doubled, and for inland trade the company can face any competition.

A paper is to be read before the Iron and Steel Institute by Mr. J. W. Wailes, the managing director of the Patent Shaft Company. For more than a year past he has been adapting the steel plant at the Patent Shaft Works to the amalgamation of the basic with the Siemens process. Several open hearth basic furnaces have been laid down, and the results, to be announced at the Manchester meeting, are likely to show that much success has been attained. It is yet too early to pronounce upon the experiments with the same combination system which the Staffordshire Steel and Ingot Iron Company are now conducting, and no definite decision has yet been arrived at as to the manner in which the new furnace shall ultimately be worked.

In accordance with the privilege conferred upon them at Sheffield

of electing the first president to the National Association of Ironworkers, the South Staffordshire men in different parts of the district have nominated various candidates for the position. The nominee who has supported the most districts will be elected. At certain of the election gatherings resolutions in favour of the Wages and Conciliation Board have been adopted.

The death is announced of the vice-president of the Iron Trade Wages Board, Mr. Thos. Piggott, ironworkers' agent, of West Bromwich. Mr. Piggott occupied the position as being the nominal leader of the operative section of the Board. He was deservedly respected by both masters and men for the soundness of his advice on wages questions, and his death, after an illness of less than a week, is a distinct loss to the Wages Board.

The directors of the Birmingham Small Arms and Metal Company have made a profit of £20,002 upon the past year's working. They recommend the payment of a further dividend at the same rate as that paid for the first half-year, making the total dividend for the year 10 per cent.

The hardware firms in Birmingham state that the United States, India, Australia, and South America are all contributing fairly to swell the demand just now, though none of the orders individually are conspicuously large or urgent, and though in all cases cheapness is a *sine qua non*. Among continental States the most promising at present are Germany and Spain, though in both these markets native competition is active and formidable.

Farmer and Chapman, Caledonian Works, report that though the season is young yet, they have already had some good lines in vases of all qualities, including expensive goods. The firm are not confining their attention this season to japanned wares, but are doing several qualities in brass. In japanned vases, too, they have several improved designs. The general trade the firm report to be fair, and above the average for this season of the year. Prospects they consider favourable. J. and W. H. Baker Bros., Batchcroft Works, are well placed with orders for japanned goods, but they make a practice of being somewhat later than the majority of firms in soliciting orders for vases or coal boxes. The vases which they will offer this year have some taking features about them.

The railway companies and the Government are tolerably good customers just now for stores of various kinds, and especially for locomotive tubes, rolled metal, ship and carriage fittings, tools, lamps, and the like.

At three of the cast-nail works in Birmingham the employers decline to withdraw their notice for a reduction in wages, and the men are still on strike. At eight other establishments the workmen are being paid at the old rates. Against the three employers indicated and the fresh hands, who have taken the place of the strikers, there is, on the part of the old men, a very bitter feeling. Allegations of partiality are made against the police, and it is declared that recent disturbances were quite unconnected with the trade dispute. The men are working strenuously for a return to the old rate of wages.

A valuable plant of machinery for wheat-cleaning was destroyed early on Wednesday morning by a fire at the extensive flour-mills at Ladywood, Birmingham, belonging to Messrs. Watson, Todd, and Watson. The machinery was of the latest type. For some time past the mills have been at work night and day, and at one o'clock on Wednesday morning a fire broke out in one of the wings. The cleaning machinery was totally destroyed, but the main building was saved by the iron doors, which shut it off from the other portion of the mill. A suggestion is made that the fire arose through the overheating of some of the bearings of the machinery.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Although there is perhaps some improvement in the condition of the iron trade, it is scarcely such as to place makers in any really better position. Taking the iron trade and the allied branches of industry all through, there is more work stirring, and here and there forges are as busy as they can possibly be. Bringing trade, however, to the test of prices, no real improvement is shown in this direction, and there is no present indication of any upward movement. The most that can be said is that there is a general firmness in holding to present prices, but makers do not seem to be able to get beyond this. The development of American requirements is being looked forward to as possibly an important factor, which may influence the market in the near future; but this is surrounded with so much uncertainty that it has no present appreciable effect, except that it encourages makers in the firm stand they have taken. Consumers, however, show no anxiety to cover themselves far forward, and for the most part they are content to go on buying simply from hand to mouth.

There was again only a dull, inactive iron market at Manchester on Tuesday, with prices unchanged. For pig iron there has been only a very limited inquiry during the past week, and the business doing is chiefly in the cheap district brands. Lincolnshire iron, which can be bought at 37s. for forge and 37s. 6d. for foundry, less 2½, delivered equal to Manchester, competes with Lancashire iron, for which makers still quote 1s. 6d. to 2s. per ton above these figures, and Derbyshire foundry iron, which can be got at about 40s., less 2½, is taking the place of Middlesbrough, for good-named foundry brands of which makers still hold firmly to 43s. and 43s. 4d. net cash, delivered equal to Manchester. For Scotch iron prices are being held more closely to quoted rates than they were, but there is comparatively little or nothing doing in this market. In fact, with the exception of moderate transactions in Lincolnshire and Derbyshire foundry iron, no business of any moment has been reported. For Lincolnshire forge iron there have been some inquiries, but consumers do not seem disposed to pay current rates, and for the present they are holding back.

The business doing in hematites continues only very small, but quoted prices remain generally firm. In some instances merchants would sell readily at 52s. 6d., less 2½, for No. 3 foundry qualities delivered into the Manchester district, but makers ask 6d. to 1s. per ton above this figure, and on the basis of about 53s., less 2½, small transactions are reported.

The improvement reported last week in the manufactured iron trade is being well maintained. Most of the makers have their books for the present full of orders, and the recent restricted output of the forges owing to the hot weather has caused the accession of business, which is chiefly for shipment, to be felt more than it otherwise would have been. There is, however, no actual pressure of orders to force up prices; but makers are adhering more firmly to their list rates, and, delivered into the Manchester district, bars average £4 17s. 6d.; hoops, £5 5s.; and sheets, £6 5s. to £6 10s. per ton.

Ironfounders report rather more work stirring, but they are not able to get any really better prices, orders being still competed for very keenly.

In the condition of the engineering trades there is a fairly general improvement as regards the actual weight of work doing; machine toolmakers are tolerably well supplied with orders; machinists, although only irregularly employed, are better off than they were a short time back, the stationary engine trade is fairly good both in light and heavy work, and boilermakers are kept busy. The locomotive building trade, however, continues only very quiet, and engineers generally, although better off for work, are not yet sufficiently busy to enable them to get any really better prices.

In the last report of the Ironfounders' Society the secretary sets forth three leading features, which he says must be cheering to the members—viz., a reduction in the number of members on benefits, a decreased cost per member still on benefits, and an increased cash balance in hand of over £1113, and, but for the dispute in the engineering trade at Bolton, their position would be better than at present. The position of the society can, however, scarcely be regarded as satisfactory, as out of a total of 11,733 members there are 2004 on donation, of whom 1087 are receiving out-of-work support, whilst, taking the returns sent in from the various districts, there are only eight—and these mostly unimportant centres—where trade is reported as good; bad, and only moderate, being the condition reported in nearly all the chief industrial districts throughout the country.

There is still no sign of any settlement of the dispute in the Bolton engineering trades. The silence of the men with reference to the last proposals, which were for a practically open arbitration, and which have really conceded as much as could possibly be expected from the employers, makes it evident, as I have previously pointed out, that the strike committee are determined only to entertain proposals based on their own terms, and, irrespective of consequences, to continue the struggle so long as funds can be found. Notwithstanding the great difficulties with which they have to contend in bringing men into the town, the employers are gradually filling up their shops, and it is possible that before long the bulk of the strike hands will find that there are no places for them to go back to.

Messrs. W. Collier and Co., of Salford, have in hand several special tools which will be of interest to notice briefly. One of these is a machine which has been specially designed for dealing with fire-box back plates at one setting, the straight edges of the plate being planed alternately with a straight cutting tool, and when these are finished, without removing the plate from its setting, the circular part is by means of a revolving table brought under the operation of a tool-box fixed upon the cramping girder, and the whole of the work thus completed. The machine consists of a bed 24ft. long, fitted with a 4in. steel driving screw and travelling carriage, and reversible tool-box to cut both ways. There is automatic motion for reversing the gearing and driving pulleys adjustable for all lengths of traverse up to 18ft. The circular table is 5ft. diameter and provided with bolt grooves for fixing the work, and is driven by independent gearing and pulleys for turning the circular part of the fire-box back plate with an independent tool box, as already described, fixed on the girder with adjustment vertically. Two other special tools are for shearing out from a steel bar, and afterwards splitting the blanks required for rolling into spades. The first, similar to a bar-cutting machine, consists of a box frame, fitted with an excentric shaft and ram, with top and bottom dies. The blank is cut into shape at two operations, by simply after the first cut turning over the bar for the second cut and fitting it against a stop, the dies being so arranged that there is no waste beyond the small piece cut out of either end of the bar, and the machine is capable of cutting out blanks in steel 1in. thick at the rate of twenty per minute. When the blanks have been cut out they are heated and passed on to the second machine, which is of similar form, but smaller than the first one, in which they are split to receive the shaft. In this machine there is an ingenious motion for stopping the ram at the top of its stroke by means of a foot lever at every revolution of the crank shaft. The machine can be run continuously without the slide descending, and by the attendant simply putting his foot on the lever it gives the one stroke required, after which the slide returns to the top and remains there for the next operation. This is effected by a slide block filling up the throw of the crank pin when the foot lever is pressed down, and thus bringing the excentric into action, which forces down the ram with the cutter, whilst by simply withdrawing the pressure from the foot lever the slide block is drawn back by a balance weight, and the slide remains at the top of its stroke.

I understand that a company is being formed in Manchester to work Messrs. Fairbairn and Wells' projectile forging machines.

In the coal trade there is only a very slow demand for all descriptions of fuel. Round coals, both of the better qualities for house fire consumption and the commoner sorts for steam and forge purposes, are bad to sell and a drug in the market, with pits not working more than four days a week; and very low prices are taken to effect sales, the average quoted figures at the pit mouth being 8s. to 8s. 6d. per ton for best coals, 6s. 6d. to 7s. for seconds, and 4s. 9d. to 5s. 6d. per ton for common round coals. With the present very restricted production of slack, colliery proprietors have not much difficulty in moving away their limited supplies of engine fuel; but the requirements of consumers are so indifferent that there is no scarcity, and prices are not more than maintained at about 4s. 6d. up to 5s. for the best qualities of burgy, 3s. 6d. up to 4s. for best slack, and 2s. 6d. to 3s. per ton for the common sorts.

The demand for shipment is only moderate, and for ordinary qualities of steam coal delivered at the high level, Liverpool, or the Garston Docks, prices average 6s. 6d. to 6s. 9d. per ton, with better class sorts in some instances fetching 7s. per ton.

Barrow.—There is a maintenance of the brisk trade in hematite pig iron, and the business done during the week, although comparatively small, is at full prices. But makers are too well sold forward to entertain much new business, and it is evident that until prices advance they will not care to enter into many new arrangements for delivery. Makers are well sold forward all round, and the stocks held are generally in the hands of merchants and speculators who some time ago were underselling makers, but who now are very firm in their transactions. Prices have not been materially changed during the past month or two, and 45s. 6d. per ton is still the quotation for parcels of Bessemer iron of mixed numbers net at makers' works, or f.o.b. at local ports. There is a full delivery of Bessemer iron to local steel makers, to steel makers in other parts of the country, and to consumers in foreign countries, including America. Stocks of iron in hand are inconsiderable, and they are being kept down by deliveries. The output of the works is well maintained, and this is likely to continue throughout the winter, not only on account of the large consumption on the part of steel makers, but because of the business doing in the general trade. The demand for steel remains brisk, and there is an especially good trade in steel. The demand is still maintained for all classes of rails from almost all parts of the world. Prices are steady at from £4 to £4 5s. per ton. Makers generally, however, are too fully sold to entertain much of the new business which is offering. There is a very steady trade in the other branches of steel manufacture in this district. Messrs. Cammell and Co., at Workington, are putting down another rail mill capable of producing 4000 tons per week, and the Barrow Steel Company are putting down a new plate mill in anticipation of the growth of trade in shipbuilding steel, of which there is every prospect. Shipbuilders are indifferently supplied with orders, although there is every indication of an improving trade in this industry. No new contracts have recently been booked, and those offering are keenly competed for. Engineers, both marine and general, are short of work, and boilermakers, finished iron and forge workers, and others engaged in the minor industries of the district, are short of work. There is no change to note in the finished iron trade, which is quiet in all departments. Iron ore is in steady demand at from 11s. 6d. to 8s. 6d. per ton at the mines. There is a good demand for best samples, but the supply is very small. The coal and coke trades are busy, and there is a full and regular delivery to consumers, and principally to manufacturers. Shipping is well employed in the export of iron ore, pig iron, and steel.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

I MENTIONED last week that Messrs. Vickers, Sons, and Co., Limited, had completed an order for 150 steel projectiles for the 13½ in. Woolwich guns, and that it was anticipated such experimental orders would be succeeded by larger requirements from the British Government. It would seem, however, that the authorities are bent upon protracting the trials. A further order for fifty armour-plate blocks has been received by Messrs. John Brown and Co. Limited, Atlas Steel and Iron Works. These blocks are used at Shoeburyness for the testing of steel projectiles, and it is pretty evident that the War-office mean to make further careful investigation before ordering stocks of any of the steel shells now in course of production. This is no doubt a thoroughly prudent course, but if war were to be "sprung" upon us, we should have no time to make steel shot in sufficient quantities to cope either with France or Russia, and the old chilled shot would be of little service in modern hostilities. One Sheffield firm is making the "Ferminy" shell, which was the first to startle our authorities by its destructive results against iron and other plates. Since then a German and a French shell have done well in competitive trials. Two Sheffield firms, declining to adopt foreign projectiles, have produced shells of their own, and these are about to be tested at Shoeburyness.

Messrs. John Brown and Co. have now at work their part of Sheffield's contribution to the security of the nation in facilities for the manufacture of huge war appliances. The River Don Works were the first to have their forging press in operation, and I have already in THE ENGINEER noticed some excellent work which it has produced, notably the forging of the 70-ton casting for the 66-ton gun. At the Atlas Works the large forging press is now fairly at work, and the first work done under it was a 20-ton shaft, which was accomplished very successfully. Messrs. Charles Cammell and Co., Cyclops Steel and Ironworks, have their forging press well in hand, and expect being ready for work this year. It is placed in a special building at Grimesthorpe, and will be a noble addition to the splendid mechanical appliances of this district.

During the whole of this year there has been an exceptionally brisk demand for railway material of all kinds, excepting articles for permanent way, the latter class of work rarely coming in this direction now. Tires and axles have been in great request, and since my last letter further good orders have been booked, chiefly on foreign account.

The new patent ribbed furnaces for marine boilers continue to be in excellent request, the orders being more than equal to the productive power of the firm who have made them a speciality. New plant is being put down for their manufacture, and by the end of the year it is expected these goods will be turned out at the rate of fifty a week.

Some anxiety is being felt with regard to the new tariff proposals of the Italian Government. A copy of the tariff lies at the office of the Sheffield Chamber of Commerce, where it has been inspected by manufacturers and others interested in the matter. Representations on the subject are to be forwarded through the Chamber to the Secretary for Foreign Affairs.

Throughout South Yorkshire generally manufactured iron keeps in steady demand, but competition with the North of England firms is severe, and threatens to continue so. Bars have been quoted as low as £4 10s. and £4 9s. at the works, though even at that price the firms who make the offer are not fully employed. Local makers of well-known brands still quote £5 per ton for ordinary qualities. Hoops are generally in good demand, and a large Rotherham firm are favoured with abundance of work both on home and foreign account. The pig iron trade keeps as dull as can be imagined, with little hope of any change for the better. The coal trade to Hull and Grimsby is active, several of the South Yorkshire collieries sending tonnages far above the average of previous seasons. There is less doing with the metropolitan market.

At the half-yearly meeting of the Hull and Barnsley Railway Company, held at Hull, the report showed that the gross revenue from all sources had been £100,238, as compared with £66,935 in the corresponding half-year of 1886, being an increase of close upon 50 per cent. The working expenses had been £68,959, being 68¾ on the gross revenue, against £59,737 in the corresponding half-year, which was 89 per cent. on the gross revenue. On the passenger traffic there was a slight increase—£2000; but in general merchandise the increase was £13,000, and the goods and coal traffic had more than doubled over the corresponding half-year. The chairman stated that prior to the opening of the Hull and Barnsley Company, the shipment rate for coal from South Yorkshire was 3s. 1d. On the opening of the railway they lowered the rate to 2s. 10d., and the North-Eastern followed suit as to the South Yorkshire collieries, though they made no alteration as to West Yorkshire. Then the North-Eastern reduced the rates 3d. per ton from their local West Yorkshire collieries. The answer of the Hull and Barnsley was to lower the rates similarly from their collieries to 2s. 7d. The next move was that within the last few days the North-Eastern had given notice that all the South Yorkshire colleries connected with Hull, and from which that company carried, would be allowed a rebate of 3d. per ton. The Hull and Barnsley have therefore responded by lowering the rate 3d. per ton to the South Yorkshire collieries. Thus the battle of the railway rates goes bravely on.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

A SOMEWHAT better feeling was noticeable at the Cleveland iron market held at Middlesbrough on Tuesday last. The amount of business actually transacted was not much greater than usual; but enquiries were more numerous, and quotations were decidedly firmer. Most of the new demand is from abroad, and for early delivery. Makers will not sell No. 3 at less than 35s. per ton, and the lowest now entertained by merchants is 34s. 4½d. If shipments continue at the same rate as at present, and stocks do not increase, they hope to obtain better prices next month. Forge iron has been in more request since the finished ironworks resumed operations. The lowest present quotation is 32s. 3d. per ton, but most holders ask more.

There is scarcely anything to report in respect of warrants. The price current at Middlesbrough and also at Glasgow is 34s. 4½d. per ton.

For several weeks past the stock of pig iron in Messrs. Connal and Co.'s Middlesbrough store has decreased; but last week this tendency was reversed, an increase of 326 tons having taken place.

Pig iron shipments are this month proceeding satisfactorily, the quantity sent away up to Monday night having been 51,923 tons. Of this quantity no less than 8065 tons was shipped on Monday together with 5678 tons of manufactured iron and steel.

Finished iron makers have recommenced work on specifications which were accumulating last week, and as there is also an improvement in inquiries, it is expected that they will be fully occupied for some time. They still quote £4 10s. per ton at works for ship plates and common bars, and £4 5s. for angles, but do not always secure the prices they quote.

At a meeting of the board of directors of Palmer's Shipbuilding and Iron Company, held at Newcastle on the 17th inst., a dividend at the rate of 3 per cent. per annum for the year ending June 30th last was decided upon.

The influx of hematite ore from Bilbao into the port of Middlesbrough has of late been very heavy. During the winter and early spring months, when the North of Spain is subject to heavy rains, selection of the ore is much more difficult than during the drier summer months. Inasmuch as the mineral is now always sold to a definite analysis—an allowance being given or received, according as the ore is under or over the percentage agreed on—it is clearly to the interest of producers to increase their output in dry weather and diminish it in wet weather. This summer happens to have been particularly wet in Spain, although just the contrary in England. Consequently there has been much difficulty in maintaining the required standard of richness, and heavy deductions by consumers have been the consequence. When the ore turns out poor in iron consumers are dissatisfied, even though they obtain the agreed allowance. They say with considerable reason that they not only do not get the metallic iron in a ton of ore which they bargained for, but the remaining mineral has more impurities in proportion to be fused and got rid of. The fact is, it is not very easy at all times and under all circumstances to maintain the standard of 50 per cent. of metallic iron in Rubio ore. This will become more and more the case as the time of exhaustion of the mineral approaches. At the Spanish mines there are even now enormous spoil heaps, as they are called, which are largely made up of ore rejected because adjudged too poor for

exportation, though without doubt much richer than most of what is produced in Great Britain. The time may come when it will pay to work these spoil heaps all over again. It is probable, however, that the ore which is exported, and which therefore has to bear the cost of sea freight, will always be the best obtainable, and that the less pure ores will be used up at ironworks situated in the neighbourhood of the mines.

The author of at least one of the incendiary fires, which have lately been devastating the town of Middlesbrough, and the would-be originator of another one, has at length been caught red-handed. Two policemen concealed in a contractors' yard, heard a noise in a building full of timber, and, proceeding to the spot, discovered a youth setting fire to a pile of wood, the flames having already reached a height of 18in. In the same building were kept the fire-escapes belonging to the town, and in a few minutes more they would have been involved in the conflagration. The youth, who is only seventeen years of age, turns out to be the son, and grandson, of Corporation employés, and he himself has been frequently employed temporarily in assisting with the fire engine. There seems to have been no motive beyond the childish enjoyment of a good blaze and the prospect of getting a small fee for assisting in extinguishing it. The antecedents of the youth are such as make it tolerably certain that he has a decided "twist" in his mental and moral nature. He does not appear to have had any accomplices, and the police believe that there are other incendiaries awaiting their opportunities in the town. Most of the large buildings which are thought likely to attract the attention of these social plagues are now being watched every night by detectives, which is, of course, the source of considerable extra expense.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow pig iron market has been unusually strong during the greater part of the present week. Iron has been held firmly, buyers declining to part with it except at advanced prices. The past week's shipments were the largest for a long time, amounting to 14,447 tons, as compared with 6528 in the same week of last year. Of the whole amount, no less than 4975 tons went to Italy, in anticipation of the increased import duties at Italian ports, while 1720 tons were for the United States. It is, of course, scarcely to be expected that the Italian demand will continue long at the same rate; but while merchants admit that this is so, they point to an increased demand for pigs on the part of our makers of malleable iron as affording further evidence of the improved condition of trade. The quantity of pig iron being sent into store is smaller than before, and there is a talk of some withdrawals taking place. There are eight-four furnaces in blast, as compared with eighty-two at this date last year.

Warrants have sold at 42s. 7d. up to 42s. 10½d. cash.

Several makers have increased the price of their iron by 1s. a ton. Free on board at Glasgow, Gartsherrie, No. 1 is quoted at 48s. 6d. per ton; No. 3, 44s.; Coltness, 54s. and 44s. 6d.; Langloan, 50s. and 46s.; Summerlee, 52s. and 43s.; Calder, 49s. and 42s. 6d.; Carnbroe, 44s. and 40s. 3d.; Clyde, 46s. 6d. and 41s. 6d.; Monkland, 43s. 6d. and 39s. 6d.; Govan at Broomielaw, 43s. 6d. and 39s. 6d.; Shotts at Leith, 49s. and 45s. 6d.; Carron at Grangemouth, 52s. and 44s. 6d.; Glengarnock at Ardrossan, 49s. and 41s. 6d.; Eglinton, 43s. 6d. and 39s. 6d.; Dalmellington, 44s. and 40s. 6d.

The past week's arrivals of Middlesbrough pigs at Grangemouth were 8787 tons against 6470 tons in the same week of last year.

Makers of malleable iron report a continuance of greater activity. Prices again mark a certain advance, and merchants are confident that the improvement in trade will be of some duration.

The past week's shipments of iron and steel manufactured goods from Glasgow embraced locomotives worth £6200 for Calcutta, a barge valued at £3750 for the same place, £5000 worth of machinery, £17,000 steel goods, including £8050 bridge work for Bombay, £4010 sewing machines, and £30,000 general iron manufactures. The last item included bar sleepers, girders, pillars, and pipes, worth £12,480, to Bombay, £4680 pipes for Kurrachee, and £3230 sheets, rails, and bars for Japan.

The export branch of the Scotch coal trade has exhibited unwonted activity in the past week, and the shipments have aggregated 99,276 tons, as compared with 85,438 in the corresponding week of 1886. The coal shipping trade of Fife, which had been so dull for several weeks that large quantities of coals were being stored at the pits, now shows a marked degree of improvement, and it is expected that there will be increased pressure in the demand for the Baltic within the next few weeks. In Ayrshire certain districts are again in the middle of holidays, and while the shipments have been greater in anticipation of the stoppage of work, the same cause will no doubt tell adversely upon the next shipping return. Prices everywhere have been a shade firmer, but it has been found impossible to obtain an advance.

There has been a very considerable amount of tonnage launched from Clyde shipyards in the course of the week. Messrs. Caird and Co., of Greenock, put into the water a fine screw steamer of 6267 tons, named the Britannia, for the Peninsular and Oriental Steam Navigation Company. She is a sister-ship to the Victoria, launched for the same owners by Messrs. Caird in May last, and is 465ft. long, 52ft. in breadth, and 37ft. in depth. She is to have triple expansion engines of 7000 indicated horse-power, and will have accommodation for 154 first-class and 156 second-class saloon passengers, and 460 third-class. In case of necessity, the Britannia will be able as a transport to carry 2700 men. This is the twenty-fifth vessel constructed by the Messrs. Caird for the Peninsular and Oriental, more than one-half of the 200,000 tons of shipping built for the company having proceeded from this Greenock yard. Messrs. Russell and Co., of Greenock, have launched the Ariosto, a screw steamer of 2989 tons gross and 4000 tons carrying capacity, with engines of 250 nominal horse-power, by Messrs. James Howden and Co., of Glasgow, for the South American trade of Messrs. Robert M'Andrew and Co., London.

Messrs. Alexander Stephen and Sons, of Glasgow, have launched the Warora, 5000 tons capacity, a steel screw steamer of 350ft. in length, for the British India Steam Navigation Company. The same firm have put into the water a steel screw steamer of 2100 tons for Messrs. James Gardiner and Co., Glasgow.

Of the twenty-five Whitworth scholarships just awarded, six have been taken by Glasgow men, and five of these, £150 each, fall to students of the Glasgow College of Science and Art.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The condition of things in the steel districts remains very much the same as last week. Most of the works are suffering from the drought, but at Tredegar, Rhymney, and Cyfarthfa a fair amount of business is being done by strictly economising the water supply. As for Dowlais, things are getting worse, and partially the works are stopped. This is regrettable, as there are good orders in hand, and some pressing for execution. The management is utilising the men in the best possible way, and the mills will be in good form when the much-needed rain makes its appearance. I went over the whole of the works a few days ago, and was impressed with their magnitude and the appliances at command. Faith in the future is strikingly shown by the storage of Bessemer pig, of ore, and of other necessities. In the matter of pit-wood, an enormous supply has been stocked at Cwmbargoed, and though the Dowlais Company is better off than any other works in foreign ore, there is no cessation in the quantities still coming to hand *viâ* the Rhymney route from Newport.

In tin bar Cyfarthfa is specially busy, and the quality is excellent. Of late there have been great clearances of stock, and huge stacks of Bessemer pig have disappeared. At no period since the restarting of the steel works has there been such briskness shown, and every credit is due to Mr. Wm. Evans for his vigorous and successful management.

There has been somewhat of a lull in the coal trade during the last week, and at Cardiff exports have fallen off considerably. This, however, has not been followed by a reduction in price, and quotations all round, steam coal, large and small, seconds, and house coal, remain the same as they have been for the last month.

The great event of the week, as regards Cardiff, is the opening of the Roath Dock, which took place on Wednesday, amidst general manifestations of delight. The dock, which gives in simple acreage an additional accommodation of 30 to 33 per cent., adds still more to the tonnage which can be grappled with, and I may safely say that never since the first opening of the Bute Docks has there been so important an event in the history of Cardiff.

It marks a conspicuous era in the dock management of Sir W. T. Lewis. When he succeeded to the control of the docks under the Marquis of Bute, the impression was general, even amongst "the officials," that the limits of the dock had been attained. Hence the support given to the Barry schemes, and the favour extended to Newport, on the one hand, and Swansea on the other by outsiders, but this Roath addition, with its Taff Vale feeder, is to be regarded as a practical inspiration, adding not only greatly to the capacity of Cardiff, but also to the more complete development of the mineral resources of Wales. North and South will benefit by it, and that in a short time.

Newport's coasting trade last week was about the average, 22,000 tons. Swansea is showing a good deal of animation, and exports in coal and patent fuel have been fairly maintained. But it is in tin-plate that this port shows a vigorous front. The shipments in tin-plate last week amounted to over 62,000 boxes, and as only 19,000 were received in stock, it is evident that prices will move. Large cargoes will be sent this and following week to the United States. Nearly 5000 tons were sent during last week to New York, Philadelphia, and Baltimore.

Ordinary cokes and Bessemers are in chief requirement, and though buyers are holding back from forward purchase, it is tolerably clear they must give way.

Cokes at the Exchange were 13s. to 13s. 3d. Bessemer steels touched 13s. 6d. Siemens', 14s. 3d., and in some cases, 14s. 6d. Charcoal tins were rather flat, but makers were firm at 15s. 6d. to 18s. 6d.; ternes, 28s. per double box. Swansea imported last week 2260 tons pig iron; 454 tons tin-plate bars; 203 tons blooms.

The railway service in Wales has been a remarkably successful one this season, both as regards coal, manufactured iron and steel, and passengers; and I should say that most of the railways will be in good condition to go in for renewals and extensions.

It is currently reported in Wales that the invention of the Westinghouse brake, which has led to such freedom from accident this season, was the invention in the first place of a man at Pontypridd. I give this with all reserve, but such is the statement. And further, it is added, that failing to get his invention taken up in this country, he went to America, and was successful in floating it.

Many of the locomotives in Wales are supplied with the automatic and other brakes, but old drivers with whom I have spoken point to the Westinghouse as the best. The fact that a driver can at full speed pull up in the length of a train shows one great cause of immunity from accidents.

The description given by W. Abraham, M.P., Rhondda, in the House of Commons Committee of the "Harbour of Refuge" which he suggested should be attached, or form part of each lamp station in a colliery, is the patent of Mr. H. Kirkhouse, of Tylorstown, who has placed one in his colliery. The opinion of the Committee was evidently in its favour, but seemed to suggest that first individual enterprise should be tried before obtaining Government enactment. Practical colliers in Wales approve of it highly.

I reserve particulars of the Roath dock opening until next week. Cardiff is *en fête*, and literally crammed from the "hills."

Rail quotations:—Heavy, £4 5s.; light, quoted up as high as £5; merchant bars, £4 10.

NOTES FROM GERMANY.

(*From our own Correspondent.*)

The position of the Rhenish-Westphalian iron market continues a favourable one, and where any alteration has taken place it has been for the better. The demand in the majority of branches is very brisk, and it may be said, without fear of contradiction, that prices in general have a very firm tendency. The Silesian market, too, is reported satisfactory. The organisation with regard to sales has stiffened it, and a rise of M. 5 p.t. in pig iron is a consequence of it, with a brisk demand. Only one of the blast furnaces was damaged by the boiler explosion at the Friedenshütte, but as the blowing engines and hoisting apparatus were destroyed, they necessarily cannot be worked, so their produce is withdrawn from the market, which causes a comparative scarcity for the moment. Fortunately the furnaces could all be tapped, so there was no "gobbing" of the hearths. Forge pig is noted M. 47·50 to 48; foundry, 52 to 54, and castings command at present improved prices. Merchants and dealers are now completing their winter stocks, and export is lively, so the forges and rolling-mills are fully occupied on bars, girders, angles, and plates. Bars are noted at M. 127·50 to 132·50 up to 145 for best sorts, and plates at 155 to 165 p.t. The steel works are busy on finished and half-finished Bessemer and basic goods. The Saar, or S.W. group of works, has raised the base-prices of rolled iron M. 4 p.t., which of course includes girders.

In the Rhenish or Westphalian districts iron ore continues in brisk demand, and prices are well maintained, as stocks are bare, on account of the miners, many of them being busy with their harvest, and not in the mines. In some cases the ores are a little dearer than last week, M. 9 to 13·50 being minimum and maximum quotations according to the sorts and qualities. Luxemburg ores are also very firm, and good contracts for long periods for export have been entered into. The prices vary from M. 1·60 to 3·20 p.t. at mines. Pig iron is in as much demand as it was. More spiegel is being sent abroad than of late was the case, but prices have remained stationary. The higher qualities, though, are still especially in demand. The call for forge pig is extremely brisk, and prices are slowly but steadily advancing, but in other sorts no great change is perceptible. From an Austrian consular report it appears that three-fourths of the raw iron imported into Austria-Hungary comes from Germany *viâ* Antwerp. In that case, surely there should be a chance for English works in those countries, with water carriage all the way! It is also stated that the good quality and price-worthiness of German iron has ousted all other competitors from Servia, Bulgaria, and Roumania. This should not be the case, if the trade were properly and intelligently cultivated by English houses. Spiegel of 10 to 12 p.c. Mn. costs M. 50 to 51; white steel iron, 44; forge pig, 43 to 45·50; foundry, 49 to 55; basic, 43; Bessemer, 50 to 51; and Luxemburg forge, 34·50 p.t. at works. Rolled iron, especially bar, continues in very urgent request for domestic consumption, and all the works are quite filled up with orders, and prices are very firm, while for export the demand is not good at all. There is little to note concerning boiler plates except that their price is too low in comparison to pig iron, but as all the works are agreed to pull together, the prices may soon be expected to rise. There is a great deal of boat and 1600-ton lighter building going on now, so the demand for the thinner sorts of ship plates is considerable. Thin black sheets are in as great demand as ever, but the enhanced prices are not being willingly acceded to by buyers. Wire rods continue to improve in consequence of the inquiries from America, and prices have stiffened. Most of the steel works are quite well employed, but rails have receded a little in price. At the last tendering at Strasburg there were offers at M. 104 p.t., while the average was 108 at works. Belgium offered the lowest for 2600 t. at M. 110 free at Ulflingen station. So far this month the machine and construction works and foundries have been much better employed, while special ones are quite fully and satisfactorily engaged. The wrought iron and steel prices were: bars of good merchant quality, M. 115; girders, 113, and higher; hoops, 110 to 115; steel billets, 112 to 125; boiler plates, 150; thin sheets, 135; heavy steel plates, 155 to 160; iron wire rods, ordinary quality, 109 to 110 and higher; steel ditto, 108 to 109; drawn iron wire, 127·50; steel ditto, 125 and higher; steel rails, 108 to 120; and light sections, 110 p.t.

Coke and coking coal are in full demand at late prices.

The canalisation of the Moselle is again coming to the front, which would cheapen crude iron production in the Westphalian basin; but to the disadvantage of the works in the Siegerland, unless they were compensated by lower railway freight on coke from Westphalia.

During the lifetime of Alfred Krupp reports were circulated regarding his works being converted into a share company, and now again it is stated that offers from Berlin to form a company have been made to the present proprietor, with what result time will show.

The active demand for iron ores at Bilbao from England, France, and Germany, has lent to the market great firmness. Prices have a rising tendency, partly from lowered stocks, partly because sellers are hanging back in expectancy of a rise in the market, because contracts for next year are being sought by buyers. Campanil is noted 7s. to 7s. 3d., and best red brands 6s. 7d. to 6s. 10d. p.t. Last week 96,873 tons were shipped; from Jan. 1st, 2,772,905 tons, against 2,085,943 tons last year.

The French iron market still shows no signs of life, and the tone is a cheerless one. The harvest makes it even stiller than it otherwise is. Orders come in sparingly, and neither the Government nor the railway companies put in an appearance upon it. The Paris quotations are 125f. for girders and 135f. for merchant iron; but for large lots good concessions on these prices would be made. Old rails cost 80f. per ton. Special sections of bar iron in the Haute-Marne districts are in a little better demand; but wire rods are neglected, as phosphor bronze has begun partly to take the place of iron or steel wire for telephones and telegraphs. The machine shops and foundries have a little more work in hand.

The Belgian iron market remains thoroughly firm, and for rolled iron prices have a decided rising tendency; still, the rolling mills find prompt sales for their output, and as pig iron—the production of which is behind the consumption—is advancing, the prices are only so much the firmer. The Luxemburg works have sold all their output of pig iron for the fourth quarter at 42f. p.t., and the blast furnaces need to be driven to their hardest to satisfy engagements. The furnaces have got up to an output of 140 t. per day. Foundry pig also finds ready sale at 45f. to 47·50f. p.t., and nearly all the make of that, too, has been sold till the close of the year. Girders are in such request for America and Italy—in the latter country on account of higher duties next January—that one principal work has advanced its price to 115f. f.o.b. at Antwerp. Plates and bars are in good demand. Steel is making great progress in superseding iron. Comparative trials of steel against wooden sleepers, made by the State Railways from 1881 to 1886, have ended in favour of the former. Two works have secured the Walrand-Delattresch patent for steel making, of which mention was made in former "Notes."

The industrial coal trade is good. The State Railways have contracted for their supply of 350,000 t. at 13½f. to 16½f. for best coal, 7¾ to 8½ for half-best, 6¾ for bituminous, 5½ for half-bituminous, and 4½ for lean coal; which are to be the current prices on the coal market till the winter. Coke costs 11·25f. to 11·50f. p.t.

LAUNCHES AND TRIAL TRIPS.

The R.M.S. Mexican, built by Mr. James Laing, Deptford Yard, Sunderland, and engined by Mr. George Clark, Southwick Engine Works, Sunderland, for the Union Steamship Company's Cape of Good Hope mail service, has had her engines converted from the compound to the tri-compound system, by Messrs. T. Richardson and Sons, of Hartlepool, and has been supplied with new boilers working at a pressure of 160 lb. per square inch. The diameters of the new cylinders are 36in., 58in., and 94in. respectively; the length of stroke 54in. The Mexican went out for her trial trip at Stokes Bay, on Friday, the 19th August. She attained a mean speed of fifteen knots per hour, and indicated 4549-horse power; her engines working at 72 revolutions per minute, with a steam pressure of 160 lb. to the square inch. This shows an increase in speed of 1·16 knots per hour, and an additional 1179 indicated horse-power, as compared with the Mexican's trial trip with the compound engines. The adoption of the triple-expansion engines will add greatly to the comfort of passengers, through the decreased vibration, while the economised consumption of coal will be advantageous to the proprietors. The Mexican is the fourth of the Union Company's mail steamers which has been converted to the new system, and it is confidently anticipated that the result will be as satisfactory as in the case of the three others, viz., Spartan, Athenian, Trojan. The Moor is about to have her engines tripled, and will be followed on her completion by the Tartar. The Intercolonial steamers Anglian and African are also fitted with triple-expansion engines. The Mexican was expected to sail for the Cape of Good Hope on the 25th August. The Mexican was engaged by the Imperial Government in 1885 to act as an armed cruiser for the defence of the Cape Colonies, in the event of war breaking out with Russia.

On Saturday Messrs. Raylton, Dixon, and Co. launched a vessel named the Gulf of Trinidad, sister ship to the Gulf of Aden, recently built for the Greenock Steamship Company for their Australasian line. She is built on three deck rule to the highest class of Lloyd's, of the following dimensions: length 312ft. 6in. by 40ft. by 25ft. 2½in., and will carry 3500 tons dead weight. Has water ballast in chambers, long poop bridge and forecastle extending almost the whole length, and every convenience up to the most modern style for a first-class merchant steamer. In addition she is fitted with handsome saloon and cabins for thirty first-class passengers. She will have engines of 300-horse power by Messrs. Blain and Co., of Stockton.

The s.s. Gulf of Aden, built by Messrs. Raylton, Dixon and Co., of Middlesbrough, for the Greenock Steamship Company, of Greenock, and sister vessel to the s.s. Gulf of Trinidad, launched by the same firm for the same owners last Saturday, has just completed loading a cargo of rails manufactured by Messrs. Bolckow, Vaughan and Co., for the first public Chinese railway, and sailed for that country after a most successful trial trip, making, we are informed, an average speed of 12 knots loaded on the measured mile. She is built on three-deck rule, to the highest class of Lloyd's, of the following dimensions:—Length, 312ft. 6in. by 40ft. by 25ft. 2½in., and will carry 3500 tons; has water ballast in chambers, long poop, bridge, and forecastle extending almost the whole length, and every convenience up to the most modern style for a first-class merchant steamer. In addition, she is fitted with handsome saloon and cabins for thirty first-class passengers. She has triple expansion engines of 350 nominal horse-power, by Messrs. Blair and Co., of Stockton.

On Monday Messrs. John Jones and Sons, Liverpool, launched a steel screw steamer 300 by 38 by 30, built to the highest class at Lloyd's, under special survey. She will carry 3600 tons dead-weight, and a very large measurement cargo. She will be fitted by the builders with triple-expansion engines, working at 160 lb. pressure, which have been designed to economise fuel to the fullest extent. Compared with iron steamers and ordinary compound engines, there can be no doubt of the superiority of vessels of this class. The steamer was built for Mr. Joseph Hoult, of Liverpool, and was gracefully christened as she left the ways by Miss Hoult. Probably we shall give an illustration shortly of the engines for this ship, which are arranged in a manner not hitherto applied to triple expansion.

NEW COMPANIES.

The following companies have just been registered:—

New Cambrian Chemical Company, Limited.

This company proposes to purchase the real and personal property of the Cambrian Chemical Company, situate in the parish of Trevethin, Monmouth, known as the Golynos Foundry. It was registered on the 13th instant, with a capital of £10,000, in £1 shares. The subscribers are:—

	Shares.
W. H. E. Barnard, 66, Southbridge-road, Croydon, clerk	1
T. Boosey, Hendon	1
W. H. Garrod, 26, Bolton-gardens, Chiswick, clerk	1
W. Webb, 198, Suffolk House, E.C., solicitor	1
C. H. Waugh, 198, Suffolk House, solicitor	1
C. F. Millett, 1, Old Palace-yard, solicitor	1
Sydney Gedge, M.P., Mitcham Hall	1

The number of directors is not to be less than three, nor more than six; qualification, 250 shares; the subscribers are to appoint the first; remuneration, £250 per annum.

New Zealand Antimony Company, Limited.

This company proposes to adopt an agreement of the 10th inst. made with William George Elder and Thomas Elder, as agents for the Endeavour Inlet Antimony Company, Limited, for acquiring certain leasehold hereditaments and lands situate at Endeavour Inlet, near Charlotte Sound, New Zealand, and to carry on mining operations thereon. The company was registered on the 11th inst., with a capital of £250,000, in £1 shares, with the following subscribers:—

	Shares.
J. A. Cotton, 66, Cannon-street, solicitor	1
Horace West, The Waldrons, Croydon	1
W. L. Buller, 52, Stanhope-gardens, S.W., barrister	1
J. Hudspith, 36, King's-road, Peckham, accountant	1
S. F. Harris, 19, Brixton-road, shorthand writer	1
J. A. Strachan, 86, Cannon-street	1
T. J. Potter, 5, Langham-road, West-green, accountant	1

The number of directors, including a resident director in New Zealand, is not to be less than two, nor more than seven; qualification, £100 in shares, stock, or debentures; the subscribers are to appoint the first; remuneration, £200 per annum each. The board will also be entitled to 5 per cent. of the annual net profits, payable out of the surplus remaining after payment of 10 per cent. dividend.

Barnard, Bishop, and Barnards, Limited.

Registered by Charles Doubble, 14, Serjeant's-inn, Temple, E.C., with a capital of £120,000, in shares of £10 each, whereof 5000 are ordinary shares and 7000 are preference shares. Object, to adopt and carry into effect, either with or without modification, articles of agreement dated respectively April 19th, 1887, and May 13th, 1887, made between John Bishop Godfrey Barnard, John Hilling Barnard, Alfred Barnard, and James Garton Bower, jun., carrying on the business of ironmongers and ironfounders, in partnership, under the style of Barnard, Bishop, and Barnards, at the shop and warehouse, No. 12, in the Market-place, in the city of Norwich, at the foundry called the Norfolk Ironworks, in St. Michael-at-Coslany, Norwich; and Nos. 91, 93, and 95, Queen Victoria-street, London, E.C.—thereinafter called the vendors—of the one part, and James Garton Bower, sen., on behalf of the company, of the other part, for—amongst other things—the purchase by the company of all the estate and interest of the vendors of and in the works, manufactories, warehouses, offices, buildings, lands and hereditaments known as the Norfork Ironworks, at Coslany-street, in the parish of St. Michael, Coslany; the sale shop and warehouses, No. 12, the Market-place, in the parish of St. Peter's, Mancroft, both in the city of Norwich; and the sale shop, showrooms and premises, Nos. 91, 93, and 95, Queen Victoria-street, London, E.C., and all the plant, machinery, tools, stock in trade, materials, stores, horses, wagons, office and other furniture, moneys, bills, notes, securities for money, credits, contracts, letters patent, licences, books, papers, trade marks, goodwill of business, properties and effects of every kind of or belonging or owing to the vendors as co-partners, the company undertaking to pay, satisfy and discharge and indemnify the vendors against all the debts, engagements, and liabilities of the said firm, other than and except the debts owing by the said firm to any of the vendors; and to carry on the business of ironfounders heretofore carried on by the firm of Barnard, Bishop, and Barnards. The first subscribers are:—

	Shares.
C. Barnard, Boston, Norfolk	1
G. Barnard, The Cedars, Norwich	1
C. Barnard, C.E., Norwich	1
J. H. Barnard, 91, Queen Victoria-street, E.C.	1
A. Barnard, Norwich	1
J. G. Bower, jun., 6, Park-lane, Norwich	1
J. G. Bower, sen, St. Martin's-lane, Norwich	1

The number of directors shall not be less than three, nor more than seven, and the first shall be Charles Barnard, Godfrey Barnary, John Hilling Barnard, Alfred Barnard, and James Garton Bower, jun. Qualification, the holding by each of at least £200 in the capital of the company. Remuneration to be fixed by the company in general meeting.

SINKING FOUNDATION FOR NEW HARLEM RIVER BRIDGE, NEW YORK.[1]

The steel bridge for crossing the Harlem River is to consist of two arches, each 510ft. span, one right across the river, and the other from the eastern bank to Sedgwick-avenue. The foundation for the central pier has been carried down to the solid rock, 45ft. below the water-level of the river. Rock, with a rapid slope towards the centre of the river, was met 15ft. below the water; and soft mud and sand, forming the river-bed, overlaid this slope. Accordingly, after the first 15ft., the timber caisson, sunk for the foundations by aid of compressed air, rested partly on rock and partly on sand and mud, which rendered its vertical descent very difficult. The caisson is 54ft. by 104ft. at the bottom, and 13ft. high; its roof is 6ft. thick, leaving a height of 7ft. for the working chamber. The sides are 3ft. thick, bevelled off at the bottom to a cutting-edge, 9in. wide, protected by an oak strip. Two longitudinal partitions, 2ft. thick, with connecting passage-ways through them, divide the working-chamber into three compartments, to within 2ft. of the bottom; and they are connected at the bottom to the side walls by struts and tie-rods. A shaft 5ft. in diameter, with an air-lock at the bottom, in the centre of the roof of the chamber, provides a passage for materials; and another shaft, with an air-lock at the top, furnishes communication for the men. The holes for blasting were drilled by hand in the solid rock under the shoe, and in the large fragments; but the drilling in the central portions was effected by a Little Giant drill, worked by air at 80 lb. pressure, which thus supplied fresh air to the caisson. The drill is mounted on an adjustable tripod with telescopic legs, so that it can work in a small space at any angle, and is readily moved. Earth was substituted for the loose rock under the shoe as the blasting proceeded; and when all the rock had been removed from under the edges to a suitable depth for one stage of sinking, the earth was gradually removed at intervals from under the shoe, and the caisson settled down by degrees. The descent was carefully watched, and earth was repacked under the shoe where expedient to retard its progress, so that the caisson might sink vertically. A dynamo provided electricity for seventy-five 16-candle glow lamps, as a distribution of several small lamps afforded a more serviceable illumination than a few arc lights. The men retired into the further compartment during a blast, and got upon the cross-braces to be clear of the space under the partitions, and out of the line of the openings. Dynamite was at first used for blasting, but rackarock was afterwards substituted with great advantage, for besides its greater safety in handling, its use was unattended with the nausea and headache caused by the fumes resulting from the explosion of dynamite. When the caisson had been carried down sufficiently for its shoe to rest almost entirely on the solid rock, all *débris* was removed from the rock, and the caisson was filled with concrete consisting of two of sand and one of Portland cement. The concrete was introduced through an 18in. tube, extending from the caisson to the surface, and provided with a door at each end. The masonry of the pier was built upon the top of the caisson as it descended, and is being rapidly completed.

[1] Proc. Inst. Civ. Engineers.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty: J. K. Medlen, to the Serapis; J. Pill, F. George, W. Tazewell, and M. Blakeman, to the Edinburgh.

An Iron Mountain.—The famous Cerro de Mercado, the iron mountain of Mexico, in the suburbs of the city of Durango, with the blast furnace, &c., nearly completed by a Philadelphia company, has been purchased, it is said by the *Mexican Financier*, by the Mexican Iron Mountain Manufacturing Company, of Des Moines, Iowa, who it is understood will develope the property immediately. Iron has been made from this deposit for a long time at a small furnace on the Tunal River, near Durango, and though analysis of the ore shows a considerable percentage of phosphorus, the iron made was exceptionally strong and tough, bringing more than the best English or Swede iron wherever it came in competition with them. All the iron was made with charcoal and was puddled with the flame from pine wood. It is said the Mexican Central will build a branch into Durango, and it is hoped the Huntington-road, which lately intersected the Central at Villa Lerdo, will be continued to the same place. Besides the freight to be expected from the ironworks, and the 25,000 or 30,000 inhabitants of Durango, the roads will be near some of the finest timber lands of the Sierra Madra, and one of the largest known deposits of tin or cusiderite in Mexico.

Removal of the Old Stockton Bridge.—In our "Miscellanea" column an accident was recorded two or three weeks ago, whereby one of the stone arches of the old Stockton Bridge fell into the river Tees, carrying with it a staging and four men. The structure was at the time in course of removal, the upper portion having been cleared away and the rows of stone forming the arch proper having been narrowed sideways to a width of little more than a yard. The staging was hung from the haunches, and was intended to receive and carry the intermediate material when, by removal of the keystone, it should lose its continuity and fall downwards. The men saved themselves by swimming, and the consequences of the accident were not very serious. But the question arose, How would the contractor deal with the three remaining arches, so as to avoid further catastrophes? To the wonder of everyone he proceeded in much the same way as before, in respect of two of them. The backings were removed, and the stones forming the arches cut away sideways, until continuity was preserved only in one comparatively slender course. One night, at about ten o'clock, the two reduced arches suddenly fell into the river. Next morning it was seen that the top of the massive stone pier which had separated them had been forced bodily over towards the middle of the river, into an oblique position. This proved that the outer of the two fallen arches had given way first, and that the thrust of the inner one had been sufficient to force over the pier. It is clear that so massive a structure would not have so easily given way had not the foundations been undermined. The bridge was more than a century old, and when built there was probably no idea of deepening the river to the extent which has since been achieved. And so the piers must have been commenced from a level only sufficiently deep for the objects then kept in view, and not deep enough to withstand the effects of modern dredging. The order of the conservancy officials not to drop the materials of the old bridge into the river has thus been entirely disobeyed, not intentionally, but under the pressure of a *force majeur* in the shape of arch thrusts of unknown intensity.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Application for Letters Patent.

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

16th August, 1887.

11,152. Bottles, &c., H. I. Leith, London.
11,153. Forming Soles for Foot Coverings, E. Lightowler, Liverpool.
11,154. Drying Granular, Fibrous, and like Materials, R. Howarth, London.
11,155. Cans for Lubricating Purposes, E. Sonnenthal, London.
11,156. Caustic Soda and Caustic Potash from their Respective Sulphates, T. T. Mathieson and J. Hawliczek, Liverpool.
11,157. Rolling or Crushing Linseed, Cotton, or other Seeds, P. and J. F. Gaskell, Manchester.
11,158. Velocipedes, H. E. Daniell, London.
11,159. Polishing Fly-wheels, G. Richards, Broadheath, near Manchester.
11,160. Cutting, Arranging, and Bundling Sticks, A. W. and M. H. Glover, Leeds.
11,161. Navigation of Canals, T. Clifford, Birmingham.
11,162. Spooling Machines, J. Halliwell, Manchester.
11,163. Preventing Trailings-in in Looms for Weaving, J. C. Cartwright and J. Turner, Huddersfield.
11,164. Tricycle Gig, S. Henshaw, Birmingham.
11,165. Regulating the Flame of Benzoline and other Lamps, W. de C. Prideaux, Wellington.
11,166. Receiving Money and Registering Tickets for Use on Omnibuses, &c., M. Ullmann, London.
11,167. Electric Differential Dial Indicator for Telegraphic, &c., Purposes, J. Kelmann, Kirkcaldy, N.B.
11,168. Mechanical Movement, A. H. Reed.—(*A. P. Massey, United States.*)
11,169. Cuff Holders, G. H. Phelps, London.
11,170. Garment Supporters, C. A. Preston, London.
11,171. Piston Valves and Ports for Steam Engines, C. T. Porter, London.
11,172. Safety Lamps, J. Bailey, Rugeley.
11,173. Correcting Spinal Curvature, &c., J. B. Hilliard, Glasgow.
11,174. Mechanical Toy, E. O. Eaton.—(*Partly communicated by A. Straus,* ——.)
11,175. Rendering Stuffing-boxes of Steam and other Engines Tight, W. C. Martyn and D. B. Hutton, London.
11,176. Nut Locks, H. Borgsmüller, Berlin.
11,177. Self-closing Safety Receptacle for Coin, &c., D. Jones, A. Serraillier, and F. J. J. Gibbons, London.
11,178. Tea Kettle, R. W. Boyd, London.
11,179. Vertical Boring Machines, J. Barrow, Edinburgh.
11,180. Dental Pluggers, S. Pitt.—(*F. Abbott, United States.*)
11,181. Printing Telegraphs, J. H. Linville, London.
11,182. Treatment of Textile Materials Dyed with Aniline Black, W. J. S. Grawitz, London.
11,183. Grinding or Levigating Substances, E. F. Goodall, London.
11,184. Metal Sleepers for Railways and Tramways, G. F. Redfern.—(*R. L. A. de la Gressière, France.*)
11,185. Seed Drills, W. Brenton, London.
11,186. Mowing and Reaping Machines, W. Brenton, London.
11,187. Pressing Wool, &c., T. Holroyd and B. Thompson, London.
11,188. Conversion of Chemical Energy into Electrical Energy, H. H. Lake.—(*W. E. Case, United States.*)
11,189. Conversion of Heat into Electrical Energy, H. H. Lake.—(*W. E. Case, United States.*)
11,190. Paper Bottles, G. A. Wilkins.—(*L. H. Thomas, United States.*)
11,191. Winding up Clocks, H. and J. Steinheuer and H. and E. Rabe, London.
11,192. Valves, &c., J. McCulloch, London.
11,193. Water-closet Pans and Traps, J. M. Hale and C. J. Simmons, London.
11,194. Heating Air or Steam, M. P. W. Boulton, London.
11,195. Incandescence Bodies, O. Imray.—(*C. A. von Welsbach, Austria.*)
11,196. Door Fastenings, E. C. G. Thomas.—(*W. Doutlin, New Zealand.*)
11,197. Children's Trays, H. J. Haddan.—(*S. A. Field, United States.*)
11,198. Stands for Newspapers, &c, P. Haddan.—(*F. D. Serié and L. Guillet, France.*)
11,199. Advertising, A. J. Curtiss, London.
11,200. Electrical Motors, A. J. Boult.—(*J. F. McLaughlin, United States.*)
11,201. Transmission of Heat, J. Tennent, Liverpool.
11,202. Saucepan and other Lids, E. Ruck, London.
11,203. Roasting Meat, W. P. Thompson.—(*A. J. Dejey, France.*)
11,204. Cleaning Finger Nails, A. J. Boult.—(*G. O. Eaton, United States*)
11,205. Gulley Trap and Channel, H. S. Cregeen, London.
11,206. Blindfolding Horses, C. H. Adams, London.
11,207. Railway Bogie Cars, W. Smith, London.
11,208. Corsets or Stays, M. J. Roberts, London.
11,209. Conveyance of Cash, &c., J. C. Martin, London.
11,210. Boring or Drilling Earth, &c., H. H. Lake.—(*S. Heilbronn, Germany.*)
11,211. Brakes, W. L. Wise.—(*A. Argo, Germany.*)

17th August, 1887.

11,212. Steam Pumps, A. W. Turner, Birmingham.
11,213. Electric Accumulators, T. J. Digby, London.
11,214. Lock-stitch Sewing Machines, J. Jackson and P. A. Martin, Birmingham.
11,215. Instantaneous Mender to Repair all Breakings, S. Bellotti, London.
11,216. Cork-drawing Machines, J. P. Jackson, Liverpool.
11,217. Attaching Letters to India-rubber, &c., I. Frankenburg, Manchester.
11,218. Equalising the Thickness of Roller Skins, J. S. Dronsfield, Manchester.
11,219. Grey and Coloured Cotton Yarns, E. Sutcliffe and G. E. Sutcliffe, Manchester.
11,220. Baskets, A. W. Powell, Bristol.
11,221. Screws and Screw-drivers, J. G. Sington, Manchester.
11,222. Sash Windows for Railway and other Carriages, J. Hanson, Bingley.
11,223. Combined Convertible Nursery Yacht, Commode Chair, and Bed, G. R. Price, Birmingham.
11,224. Cartridges, H. Tolley, Birmingham.
11,225. Feed-heating Apparatus for Steam Boilers, T. Gilmour, Glasgow.
11,226. Triple-expansion Steam Engines, J. Howden, Glasgow.
11,227. Filters for Wine, &c., J. P. Jackson, Liverpool.
11,228. Devapourising Windows, W. H. Blakeney and G. D. Macdougald, Dundee.
11,229. Wheel Stilts, S. Davies, London.
11,230. A New Beverage, T. Needham, Huddersfield. —[16*th August*, 1887.]
11,231. Electrical Switches, H. B. Bourne and W. Mackie, London.
11,232. Regulating the Surface Flow of Wort from Coolers used in the Manufacture of Beer, R. Ranger, London.
11,233. Electro-deposition of Metals, J. Hollnay, London.
11,234. Working Railway Signals, &c., R. Snyers, London.
11,235. Looms for Weaving, M. Corrigan, Glasgow.
11,236. Pin Pliers, J. C. Young, London.
11,237. Hearths of Fireplaces, &c., H. Noble and G. Haley, London.
11,238. Boots, Shoes, &c., V. W. Chapman, Birmingham.
11,239. Diving Dresses, A. Marshall and T. Louttit Liverpool.
11,240. Cutting the Stream or Length of Clay from Brick or Tile Machines, R. Parry, Liverpool.
11,241. Rotary Engines, W. P. Thompson.—(*W. C. Doun, United States.*)
11,242. Scarf Pin, J. Weiss, London.
11,243. Candle Shade Supports, &c., Sir H. C. E. Malet, Bart., London.
11,244. Sliding Gasaliers, &c., T. Carpenter, London.
11,245. Billiard Cue Suspenders, J. Roberts, jun., London.
11,246. Automatic Lock for Carriage Doors, W. Hammon, London.
11,247. Urinals, T. W. Garrood, London.
11,248. Tufting Tools, H. Saqui and S. Lawrence, London.
11,249. Knives of Chaff-cutting and other Machines, F. K. Woodroffe, London.
11,250. Lighting Railway Cars, E. J. Frost, London.
11,251. Cigarettes, W. H. Schwartz, London.
11,252. Secondary Batteries or Electrical Accumulators, H. Mower, London.
11,253. Tanning and Tanning Apparatus, T. Palmer, London.
11,254. Stopping and Starting Vehicles, J. J. Hooker, H. Lescher, and R. G. Schwarz, London.
11,255. Gas and Pumping Engines, P. M. Justice.—(*W. E. Hale, United States.*)
11,256. Danger Indicators, H. E. Newton.—(*G. Allman, New Zealand.*)
11,257. Ironing Machines, E. L. T. Caron, Nottingham.
11,258. Clip or Holder for Retaining Cuffs, &c., in Position, G. A. Fisher, Birmingham.

18th August, 1887.

11,259. Pockets of Trousers, &c., J. L. Emary, London.
11,260. Making Metal Articles with Porcelain, &c., Linings, T. E. Halford and R. Morant, Chiswick.
11,261. Reducing the Strain on Picking Bands in Looms for Weaveng, R. Dean, London.
11,262. Automatic Fire-extinguishing Sprinklers, J. H. and J. W. Galloway, London.
11,263. Pumps, S. Whittaker, London.
11,264. Safety Screw or Lock Nuts, J. E. A. Gwynne and J. J. Claret, London.
11,265. Flush Bolts, H. F. Bangert, London.
11,266. Paper Files, A. Schapiro, Berlin.
11,267. Core Barrel, W. Priestland, Chesterfield.
11,268. Sodium and Potassium, G. A. Jarvis, Salop.
11,269. Eye of a Needle, F. F. Abbey, Huddersfield.
11,270. Mechanism for Dancing Dolls, G. F. Lutticke, Hove.
11,271. Busts, M. Cramby, Bradford.
11,272. Belt Fastener, J. Knowles and W. E. Wood, Accrington.
11,273. Screw-binder Worked with Key, F. Harrison, Bradford.
11,274. Treatment of Lime Mud, J. S. Rigby, Liverpool.
11,275. Spinning and Doubling Cotton, J. Seed, Manchester.
11,276. Treatment of India-rubber Goods, R. S. Baxter, Broughty Ferry.
11,277. Pulley Box, W. E. and W. M. Winby, Birmingham.
11,278. Self-winding Clocks, H. N. G. Cobbe, Birmingham.
11,279. Method of Travel of Pistons, A. Hardeman Sparkbrook.
11,280. Weighing Machines, E. Wölner, Liverpool.
11,281. Metal Surfaces, F. Crane.—(*J. Hale, United States.*)
11,282. Fixing Roller Blinds, A. T. Allom and E. O. Eaton, London.
11,283. Tiles, W. Bull, London.
11,284. Valves, J. Smeaton and J. D. Simpson, London.
11,285. Rubber Composition Strips, R. Hannan.—(*J. J. C. Smith, United States.*)
11,286. Wax Matches, J. Masters, London.
11,287. Ventilating Rooms, De F. Pennefather, London.
11,288. Whip Sockets, E. Jeffries, Birmingham.
11,289. Coloured Photographic Printing, J. Greth, London.
11,290. Scapewheel Height Tool, G. Cornioley and C. J. Dunlop, London.
11,291. Punch Holder, G. Cornioley and C. J. Dunlop, London.
11,292. Refrigerators, J. S. Croft and G. T. Appleyard, London.
11,293. Suspenders, J. F. Miles, London.
11,294. Folding Stool with Chair Back Attachment, H. F. Henry, London.
11,295. Thermometers, W. Hiergesell, London.
11,296. Bearings for Vehicles, &c., C. A. de A. Basto, London.
11,297. Door Latches, H. H. Lake.—(*E. S. Winchester United States.*)
11,298. Gas-burners, J. Pintsch, London.
11,299. Silk Hats, C. Vero, Warwickshire.
11,300. Raising Water for Supplying Baths, &c., W. Green, London.
11,301. Ploughs, J. E. Ransome and F. W. Garrard, London.
11,302. Finishing Felt Hats, C. Vero, London.
11,303. Sewing Machines, J. and R. J. Foot, London.
11,304. Fastening for Windows and Sashes, J. Gilbert and J. F. Golding, London.
11,305. Gas Lamps, T. C. J. Thomas, London.
11,306. Gas Lamps, T. C. J. Thomas, London.
11,307. Rope Ladders, W. H. Wheatley.—(*H. French, United States.*)
11,308. Grain Dryers, W. H. Wheatley.—(*L. H. Wales, United States.*)
11,309. Wardrobes, W. H. Wheatley.—(*C. H. T. Claus, United States.*)
11,310. Boilers, &c., E. Edwards.—(*E. M. Heiber, Germany.*)
11,311. Preparation of Cocoa, G. Grout, London.
11,312. Velocipedes, C. M. Linley and J. Biggs, London.
11,313. Wheels for Velocipedes, &c., W. Lea, London.
11,314. Forks, &c., W. Hassel, London.
11,315. Dynamo-electric Machines, H. H. Lake.—(*G. E. Cabanellas, France.*)
11,316. Flushing Cistern and Water-waste Preventer, R. C. F. Wyatt, London.
11,317. Lighting by Electricity in Coin Receiver Apparatus, W. S. Simpson, London.
11,318. Alpha-naphtholdi-sulpho Acid, &c., H. H. Lake.—(*Wirth and Co, Germany.*)
11,319. Magazine and other Fire-arms, J. P. Lea, London.

19th August, 1887.

11,320. Infant's Feeding Bottles, G. Hartmann, London.
11,321. Attaching Door Knobs to Spindles, W. Harrington, Kidderminster.
11,322. Bottle Stopper and Bottle Neck Combined, C. Johnson, Sheffield.
11,323. Boots and Shoes, W. Sutcliffe, Halifax.
11,324. Lavatories, J. Smith and A. Roberts, Manchester.
11,325. Henrietta Cloths, F. Pollard, Bradford.
11,326. Sofas, J. R. Ambler and H. A. Lund, Keighley.
11,327. Spindles, W. Sumner, Holland.
11,328. Pocket Pen-cases, M. Myers and J. Lowe, Birmingham.
11,329. Hood for Perambulators, J. H. Atkinson, Leeds.
11,330. Holders for Incandescent Lamps, C. M. Dorman and R. A. Smith, Manchester.

11,331. Axminster or Chenille Carpets, R. and G. Morton, Glasgow.
11,332. Looms, G. Morton, Glasgow.
11,333. Driving Mechanism for Telpher Trains, C. Spencer E. Crakanthorp, London.
11,334. Wood Planing Machines, A. E. and R. Knox, Glasgow.
11,335. Printing in Colours, T. D. Worrall, London.
11,336. Indicating Distances Travelled by Vehicles, J. Inglis, Glasgow.
11,327. Mechanical Connexion, R. Snyers, London.
11,338. Cutting Paper Tubes into Lengths, W. H. Allen, London.
11,339. Syphon Flushing Cisterns, E. J. Finch, London.
11,340. Boxes, W. W. Lawson, London.
11,341. Secret Writing, M. A. Wier, London.
11,342. Lamps, J. Blankley and C. Tallman, Ohio.
11,343. Attaching Teats to Feeding Bottles, E. Woodham and P. Ockenden, London.
11,344. Incandescent Gas Burners, J. R. Turnbull, London.
11,345. Gas Motor Engines, H. Lindley and T. Browett, London.
11,346. Sewing Machines, R. Pottage, London.
11,347. Weighing Machines, E. Roche, London.
11,348. Files for Letters, S. Maier.—(*F. S. Verlag, Germany.*)
11,349. Apparatus for Delivery of Goods, W. J. Woodward, London.
11,350. Delivery of Pamphlets, &c., W. J. Woodward, London.
11,351. Cartridge Extractors, C. H. Maleham, Sheffield.
11,352. Bottle Washing, &c., Apparatus, J. Masson, London.
11,353. Vehicles, A. Dickinson, Birmingham.
11,354. Carriage and Cart Brakes, Z. Smith, London.
11,355. Preparation of Cotton Fibres for Dyeing, W. J. S. Grawitz, London.
11,356. Electric Couplings, C. Runels, London.
11,357. Bottle Stoppers, W. Beardsley, London.
11,358. Needles, G. F. Sumner, London.
11,359. Tree Guards, L. O. Benoist, London.
11,360. Double-acting Presses, C. Roux, London.
11,361. Facilitating Telephonic Communications, J. S. Ross and H. Baines, London.
11,362. Parallel Ruler, H. H. Lake.—(*B. L. Aguettant, France.*)
11,363. Cocks, Taps, or Valves, W. H. Tylor, London.
11,364. Candlestick, A. Steer, London.
11,365. Saving Life at Sea, J. McKirdy, London.
11,366. Ship's Porthole Lights, J. McKirdy, London.

20th August, 1887.

11,367. Making Illuminant Gas, &c., G. Thew, J. Stansfield, and G. Long, Farnworth.
11,368. Securing Fabrics to Rollers, &c., R. A. Matthews, Nottingham.
11,369. Electric Batteries, C. Gauzentés, Bradford.
11,370. Loading Coal, &c., without Breakage, into Trucks from Sorting Bands, H. J. Plowright, Chesterfield.
11,371. Sanitary Receptacles, H. Whiley, Manchester.
11,372. Portable Gas Lamp, J. S. Miller, London.
11,373. Coal Vases, &c., G. Smith and F. G. Liddington, Birmingham.
11,374. Packing for Glands, &c., F. Reddaway, Manchester.
11,375. Spindles of Ring-spinning, &c., Machinery, W. Sellers, Keighley.
11,376. Cleaning Malting Tiles, F. G. Burton and T. S. Coleman, Burton-on-Trent.
11,377. Stoppers for Bottles, D. Rylands and B. Stoner, Barnsley.
11,378. Attaching Knobs to their Spindles, J. H. Cartland, Birmingham.
11,379. Driving Velocipedes, J. R. Hudson, J. W. Marshall, and T. W. Cook, Manchester.
11,380. Railing for Enclosures, D. Rowell, London
11,381. Ball-boxes or Valves of Hydrants, F. Ashton, Halifax.
11,382. Double-bodied Baking and Cooking Oven, L. Mitchell, Higher Audley.
11,383. Easels, M. Browne, Leicester.
11,384. Construction of Bed Mattresses, &c., E. Howell, Glasgow.
11,385. Continuous Screw Propeller for Ships, T. A. Segrave, Dublin.
11,386. Projectiles Provided with Rings of Copper, R. S. Courtman, London.
11,387. Strengthening Stays or Belts, S. Merrick, London
11,388. Spikes for Holding Down Railway Chairs, C. Harvey, Sheffield.
11,389. Detaching Horses from Four-wheeled Vehicles, W. and W. F. Lear, London.
11,390. Elements for Secondary Batteries, J. S. Stevenson, London.
11,391. Claw Fastener for Neckties, H. Pentony, London.
11.392. Hot-air Engines, E. Schindler and E. Robotham, London.
11,393. Deoderising, &c., Medium, O. Bowen and J. Cobeldick, London.
11,394. Dyeing Cotton, &c., J. H. Gartside and J. Barnes, Manchester.
11.395. Shaft for Screw Propellers, I. E. Clifford, London.
11,396. Instruments for Killing Birds, W. Moffat, Glasgow.
11,397. Saucepan Handle, C. H. Gosling, London.
11,398. Turning, &c, Venetian Blinds, S. Carnaby, Liverpool.
11,399. Fire-escapes, A. de Waele, Belgium.
11,400. Raising Wrecks, &c., J. W. Hobson, London.
11,401. Feeding Fuel to Steam Boilers, A. H. Stott, Oldham.
11,402. Internal Stopper for Mineral Water Bottles, J. Ruth and J. Lasham, London.
11,403. Machine Guns, T. Nordenfelt, London.

22nd August, 1887.

11,404. Cleaning and Polishing Knives, &c., L. West, London.
11,405. Using Water of Brooks, &c., M. Mitchell, Rochdale.
11,406. Windlasses and Capstans, R. J. Rae, London.
11,407. Candle Shade Supports, M. M. Whyte, Elgin.
11,408. Anti-friction Bearings, W. Smith, D. Marks, and R. Watson, Keighley.
11,409. Artificial Upholstering Hair, R. J. Stratford, London.
11,410. Rendering Doors, &c., Air-tight, J. C. Reid, Leeds.
11,411. Raising and Lowering the Galleries of Oil Lamps, G. Foggo and E. Rutter, Glasgow.
11,412. Calcining and Heating Argillaceous, &c., Substances, B. H. Thwaite, Liverpool.
11,413. Automatic Candle Shade Holders, C. E. Haseler, Birmingham.
11,414. Hanging of Pictures, J. Walker, Birmingham.
11,415. Adaptation of Electric Light or Heat from Primary or Secondary Batteries, &c., A. W. Armstrong, London.
11,416. Measuring Machines, W. F. Stanley, South Norwood.
11,417. Electrical Connections with Moving Bodies, T. A. Garrett, London.
11,418. Means for Heating Purposes, &c., A. F. Stone and J. Black.—(*G. Geer and S. G. Sea, United States.*)
11,419. Hats, E. de Pass.—(*S. Piron, France.*)
11,420. Cutting Paper and Cards, &c., C. E. Gyngell, Wellington.
11,421. Shuttlecock and Battledore Toy, T. Hardman, Liverpool.
11,422. Causing Common Road Vehicles to Ride Smoothly without the Aid of Springs, J. H. Levick, London.
11,423. Targets for Rifle Practice, T. B. Ralston, Glasgow.
11,424. Air Chambered and Receding Party Walls, J. Carter, London.
11,425. Tape Warp Beaming Machines, E. W. Wrigley, London.
11,426. Passing Warps into and Receiving them from Dyeing Machines and Drying Cylinders, E. W. Wrigley, London.
11,427. Simultaneously Automatically Measuring and Indicating the Height and Weight of Human Beings, E. Parr and E. Edwards, London.
11,428. Letter-press Printing and Numbering Machines, D. Carlaw, Glasgow.
11,429. Coupling and Uncoupling Rolling Stock, E. Webb, London.
11,430. Railway Wagon or Truck, W. and E. Clifford, London.
11,431. Sliding Windows, T. R Oswald and J. M. Mordaunt, and J. F. Morrison, London.
11,432. Blasting in Coal Mines, &c., G. Trench, London.
11,433. Sharpening Pencils, A. W. Mason, London.
11,434. Syphon Cisterns, O. Elphick, London.
11,435. Ventilation, A. T. Allom, London.
11,436. Indicating the Velocities of Water and Air, J. Gordon, jun., London.
11,437. Cutting Pile Fabrics, J. H. Smith, A. Goddard, L. Higginbottom, and T. Mannock, London.
11,438. Fireproof Holders for Joists, J. A. Cantle, London.
11,439. Hydraulic Mains for Gas Works, W. C. P. Asselbergs, London.
11,440. Purifying or Washing Gas, W. C. P. Asselbergs, London.
11,441. Separating and Cleaning Fibrous Material, W. S. Archer, London.
11,442. Washing, Wringing, &c., Machines, F. Auspitz, London.
11,443. Life-saving Raft for Ships, J. W. Miller, London.
11,444. Igniting Apparatus for Gas Motor Engines, C. D. Abel. —(*The Gas Motoren Fabrik, Deutz, Germany.*)
11,445. Surgical Apparatus for Making Incisions without Pain, A. J. Boult. —(*J. F. da Silva, Madeira.*)
11,446. Sewing Machine for Corsets, P. A. Darraig, London.
11,447. Combined Machines for Breaking and Scutching Flax, Hemp, &c., A. J. Boult.—(*G. Raulich and J. Nesetril, Austria.*)
11,448 Secondary Batteries or Electrical Accumulators, J. S. Sellon, London.
11,449. Obtaining Chloride of Aluminium, &c., J. Clark, London.
11,450. Illuminating Gas, A. Eichelbrenner, London.

SELECTED AMERICAN PATENTS.

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

365,119. Condenser, *W. Craig, Brooklyn, N.Y.—Filed April 7th*, 1887.

Claim.—(1) The combination, with a condenser body and an upper chamber having inlets for steam and water and communicating by a throat with the body, of a valve in said throat, a pipe or passage leading downward from the throat and fixed in position within the body, a float arranged laterally beyond the pipe or passage, and connections between said valve and float, substantially as herein described. (2) The combination, with a condenser body and an upper chamber having inlets for steam and water and communicating by a throat with the body, of a valve in the throat, a pipe or passage extending downward from the throat, an annular float loosely surrounding, but not fitting, the pipe or passage, and connections between the float and said valve, substantially as herein described. (3) The combination, with the body A and the upper chamber having inlets for steam and water and communicating by a throat b^1, with the body, of the valve B in the throat, the pipe or passage D, the annular float E, loosely surrounding the pipe or passage, the guiding frame or spider E^1, connected with the float, and the rod E^2, connecting said frame or spider with said valve, substantially as herein described. (4) The combination, with a condenser body and an upper chamber having steam and water inlets and communicating by a throat b^1 with the body, of a valve in said throat, and a throttle valve for controlling the supply of steam for operating a pump, a float arranged within the condenser body, and connections between the float and said two

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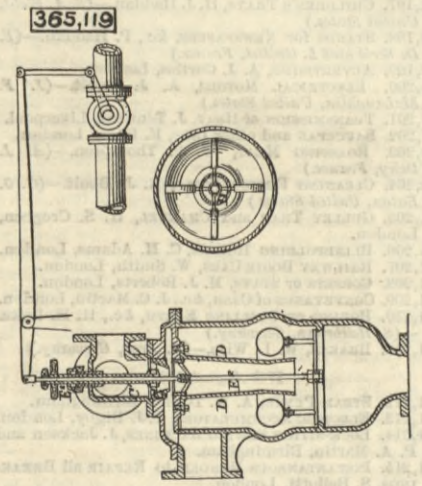

valves, whereby the rising movement of the float will diminish the flow of water through said throat, and will more or less close the throttle valve, substantially as herein described. (5) The combination, with the condenser body and an upper chamber having steam and water inlets and communicating by a throat with the body, of the valves C B, arranged opposite each other in the steam inlet and throat, the tubular stem C^1 for operating the valve C by hand, the pipe or passage D, the annular float loosely surrounding the pipe or passage, and the rod E^2, connecting the float with the valve B and prolonged upward through the tubular stem C^1 to the valve-operating lever E^3, substantially as herein described. (6) The combination, with the condenser body and an upper chamber having steam and water inlets and communicating by a throat with the body, of a valve B, for controlling the flow of water through the throat, a device for controlling the supply of steam to an engine in connection with which the condenser is used, and connections between the valve B and said controlling device, whereby the valve B and said device will be operated simultaneously to correspondingly increase or diminish the supply of water through the throat and the supply of steam for operating the engine, substantially as herein described.

365,136. Elastic Balance Valve, *J. Lewis, South Evanston, Ill.—Filed October 7th*, 1886.

Claim.—(1) As a new manufacture, the plug valve having elastic or expanding cheeks and a central exhaust, substantially as set forth. (2) The plug valve provided with expanding cheeks, and a yielding clamp resisting the expansion of the cheeks, substantially as specified. (3) The plug valve consisting of the shell, the expanding cheeks, and the yielding clamp, all combined and operating substantially as specified. (4) The shell, in combination with the expanding cheeks, having shanks fitting transversely in said shell, and the bolt and springs holding the cheeks together and resisting the pressure upon them, substantially as specified. (5) The shell opens transversely to receive the cheek shanks, and having a central exhaust, in combination with the expanding cheeks having shanks entering the shell and ports open to said central exhaust, and a clamp holding the cheeks together, substantially as specified. (6) The shell, in combination with the expanding cheeks and the packing confined in the recesses D in the latter, substantially as specified. (7) In a valve, the expanding cheeks covered by the brass plates E, cast upon the the cheek with its metal filling the countersunk open-

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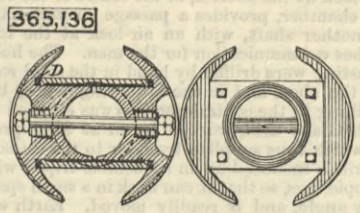

ings in the plates, substantially as specified. (8) In a valve, a shell, in combination with the expanding cheeks having the hollow guiding shanks, the open ports, and the interior surfaces *s s*, to receive the expanding pressure of the steam, substantially as set forth. (9) The valve casing, in combination with an elastic plug valve having ports, as set forth, and a central hollow spindle serving as an exhaust, substantially as specified. (10) The valve casing, in combination with an elastic plug valve rotating or oscillating therein, the casing having an open space at each end of the plug to balance the pressure thereon, substantially as specified.

365,120. Centrifugal Apparatus for Testing Milk, *G. de Laval, Stockholm, Sweden.—Filed August 22nd*, 1885.

Claim.—(1) A testing apparatus for milk, composed of a glass tube, a holder for the same having a hollow plug at one end, and a box to hold the milk, and into which the hollow plug fits accurately, substantially as

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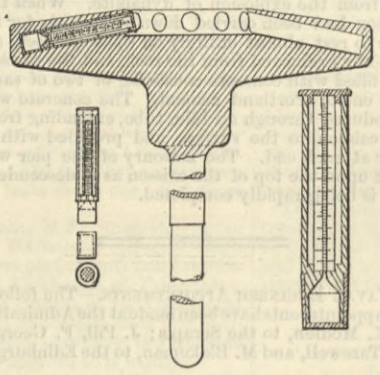

specified. (2) The combination, with removable testing tubes for holding milk, of a horizontal circular plate having central and radial recesses for the reception of hot water and for the testing tubes, and a vertical shaft for supporting and revolving the horizontal plate, substantially as specified.

365,153. Automatic Oiler, *J. T. Smith, San Francisco, Cal.—Filed October 2nd*, 1886.

Claim.—(1) A lubricating tube having its lower end contracted, in combination with an independent disc of metal, swaged or compressed into the contracted end of the tube, so as to form a bottom, and having a central opening, and radial channels in its lower surface, intersecting with the central opening, substantially as herein described. (2) The lubricating tube extending downwardly and a perforated bottom swaged or secured within the tube, as shown, in combination with a screw-threaded disc having a shank or stem extending upwardly into the cup, said disc travelling in corresponding threads in the upper end

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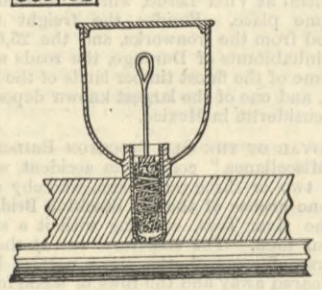

of the tube, a packing of fibrous material in the lower end of the tube, and a spiral spring having its interior filled with a similar packing, which may be compressed and expanded with the spring by the action of the disc, substantially as herein described. (3) A lubricating tube extending downwardly, with a convex perforated bottom fitted into it, as shown, in combination with a screw stem or shank extending downwardly into the tube, having a tapering or conical pointed lower end, and a collar at the upper end of the cone, and the fibrous packing and spring into which the cone point extends, substantially as and for the purpose herein described.

365,246. Journal-box and Lubricator, *Albertus Eagle, Northampton, Pa.—Filed January 5th*, 1887.

Claim.—A combined journal-box and lubricator consisting of the journal-box A, with chamber F, the outer side walls of which furnish the bearings for the

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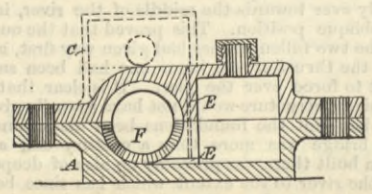
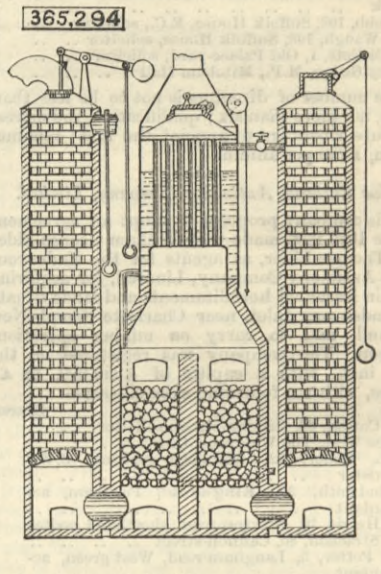


shaft, the said chamber having bevelled inner sides at the lower portion thereof, and the lubricator cup C, with the duct E, leading to the lowest part of chamber F, said parts being combined and operating substantially as described.

365,294. Apparatus for Manufacturing Gas, *B. Brazelle, St. Louis, Mo.—Filed November, 2nd*, 1886.

Claim.—(1) In an apparatus for the manufacture of gas, the combination, substantially as set forth, of a combustion chamber having an opening at its top, a vertical wall or partition dividing said chamber into two compartments communicating at top, a grate located in the lower portion of each of said compartments, a steam boiler covering the top of the combustion chamber, a valve governing the passage of the products of combustion through the tubes of the boiler, and a pair of regenerator chambers each connected by a passage or channel with a compartment of the combustion chamber below the grate thereof. (2) In an apparatus for the manufacture of gas, the combination, substantially as set forth, of a steam boiler, a combustion chamber divided by a wall or partition into two compartments communicating at top, a grate located in the lower portion of each of said compartments, a regenerator chamber communicating with each of said compartments below the grate, each of said

365,294



chambers being fitted with a discharge valve, an air-blast valve controlling a pipe communicating with one of the regenerator chambers, and a steam-supply valve controlling a pipe leading into the other regenerator chamber. (3) In an apparatus for the manufacture of gas, the combination, substantially as set forth, of a combustion chamber having an upper throat or opening, a steam boiler located above and covering said throat, a wall or partition dividing the combustion chamber into two compartments communicating at top, a grate located in the lower portion of each of said compartments, a regenerator chamber communicating with each of said compartments below the grate, and pipes and valves governing the traverse of a blast of air and a current of steam into and through the regenerator chambers and compartments of the combustion chamber.

365,305. Vault Light, *P. Herzog, Minneapolis, Minn. —Filed July 23rd*, 1886.

Claim.—In a vault or other light, the frame B, a portion of the base of which is straight and a portion convex to form a projection, in combination with the

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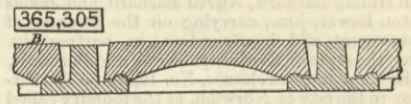

glass provided with a groove for the reception of the projection upon the frame, the outer sides of which glass are of a less height than the edge of the concave portion, for the purpose of leaving a greater cementing area, substantially as shown and described.

365,325. Machine for Bending Rails, &c., *J. Abbott, Blackheath, Kent, England.—Filed May 9th*, 1887.

Claim.—(1) In a rail-bending apparatus, the combination of the rollers and the frame A A^2 extending

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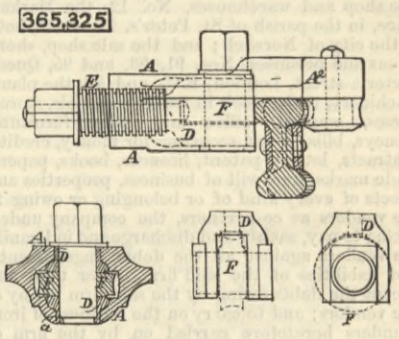

between the rollers, and having guides *a*, with a carrier D adapted to the guides, and having a roller F and a screw E, substantially as set forth. (2) The

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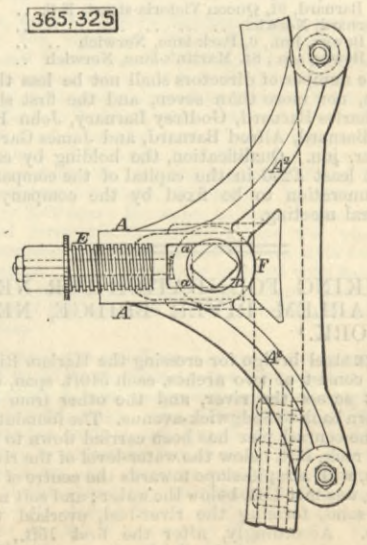

combination of the frame having guides *a* a rollers B C, with a carrier D adapted to the guides an carrying a roller, a screw E, and securing bolt *e*, sub stantially as specified