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THE ENGINEER, March 29th, 1889.

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TO CORRESPONDENTS.

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S. B. (Blackheath to Fen).—*If you will send a sketch showing the elements of your valve gear, with a brief description, we will give you our opinion on its merits, in confidence.*

R. A. B.—*The displacement is settled by the lines—in other words, by the shape of a ship, as well as by her length, breadth, and depth. The Italian ships are no doubt somewhat "leaner" ships than the proposed English vessels will be.*

WIRE STRANDING MACHINES.

(To the Editor of The Engineer.)

SIR,—Will any of your readers tell us the names of makers of wire stranding machines? C. B. AND N.

SLATE MACHINERY.

(To the Editor of The Engineer.)

SIR,—Will any of your correspondents kindly send us full particulars, prices, and best trade terms for machinery for sawing and planing "argillons" and slate stones for roofs of houses and for flag paving stones, &c.? SLATES.

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Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. Sydney White; all other letters to be addressed to the Editor of THE ENGINEER.

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, April 2nd, at 8 p.m.: Ordinary meeting. Paper to be further discussed:—"The District Distribution of Steam in the United States," by Dr. Chas. E. Emery, M. Inst. C.E. Paper to be read, time permitting:—"Armour for Ships," by Sir Nathaniel Barnaby, K.C.B. At this meeting the monthly ballot for Members will take place. Friday, April 5th, at 7.30 p.m.: Students' meeting. Paper to be read:—"Moulding and Casting Cylinders for Marine Engines," by Mr. R. J. Durley, B.Sc., Stud. Inst. C.E.; Mr. John Donaldson, M. Inst. C.E., in the chair.

SOCIETY OF ENGINEERS.—Monday, April 1st, at the Westminster Town Hall, at 7.30 p.m.: Ordinary meeting. Paper to be read:—"Fire-proof Floors," by Mr. G. M. Lawford, Assoc. M. Inst. C.E., of which the following is a synopsis:—Roman floors—Invention of pugging—Development of the concrete and iron joist floor—Objects of fire-proof flooring—Detailed descriptions of the floors now in vogue in English practice—Other systems, including the French and American floors—Fire-proof plasters and paints—Merits and defects of the different floors, and types of construction—Leading features to be considered—Conclusion.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—Wednesday, April 3rd, at the Westminster Palace Hotel, Westminster, at 7 p.m.: Ordinary meeting. Paper to be read and discussed:—"The Roadstones of Somerset and Wilts," by Mr. James Bateman.

GEOLOGISTS' ASSOCIATION.—Friday, April 5th, in the Mathematical Theatre, University College, Gower-street, at 8 p.m.

SOCIETY OF ARTS.—Monday, April 1st, at 8 p.m.—Cantor lectures: "Instruments for the Measurement of Radiant Heat," by Mr. C. V. Boys, A.R.S.M., F.R.S. Lecture II.—All instruments of an electrical character require a thread suspension—Properties of wire, spider, glass, and quartz threads—Silk and quartz compared—Details of the manufacture of quartz thread, and instructions for preserving and mounting them. Tuesday, April 2nd, at 8 p.m.—Foreign and Colonial Section: "The Argentine Republic," by Mr. F. K. Smythies. Wednesday, April 3rd, at 8 p.m.—Ordinary meeting. "Fruit Growing for Profit in the Open Air in England," by Mr. W. Paul, F.L.S.

ROYAL INSTITUTION.—Friday, April 5th, at nine o'clock, the evening discourse will be given by the Rev. Canon Ainger, M.A., on "True and False Humour in Literature." Monday, April 1st, general monthly meeting, at 5 p.m. Afternoon lectures at three o'clock:—Tuesday, April 2nd, "Before and After Darwin. II. Evolution," by Mr. George J. Romanes, F.R.S. Thursday, April 4th, "Houses and their Decoration from the Classical to the Mediæval Period," by Professor J. Henry Middleton, M.A. Saturday, April 6th, "Experimental Optics—Polarisation; Wave Theory," by the Right Hon. Lord Rayleigh, F.R.S.

DEATH.

On the 22nd inst., at his residence, Cottingham, Westwood, Southampton, THOMAS SUMMERS, M.I.C.E. and M.I.N.A., in the 64th year of his age; late of the firm of Day, Summers, and Co.

THE ENGINEER.

MARCH 29, 1889.

THE RELATIONS BETWEEN LOCAL FORTIFICATIONS AND A MOVING NAVY.

IN a famous pamphlet, written some half-century ago, the great master of logic, Archbishop Whately, proved most conclusively that there were no rational grounds for believing that Napoleon Buonaparte ever existed at all. By a similar process of reasoning, or *un*reasoning, Admiral P. H. Colomb has sought to convince an audience at the Royal United Service Institution that the existence of a more perfect system of defensive works around the coasts of the United Kingdom would be practically useless in the event of war, and that powerful fortifications would be positively detrimental to our foreign possessions, such places as Malta and Gibraltar being a source of weakness and not of strength, the danger attaching to their existence increasing in the same ratio as the works themselves progress towards final completion. With all due regard for the gallant admiral's opinion, it is impossible to avoid the conviction that he has endeavoured to prove a little too much. That he holds remarkable views as regards the value of strongly fortified positions is well known to all those who have listened to his able speeches upon the subject of naval strategy and the science of blockade, in which last subject he is so peculiarly at home; but we do not for a moment believe that Admiral Colomb was seriously propounding a genuine conclusion when he finished a paragraph in his paper with the following statement:—"I conceive we have established the fact that, before a country can employ such fortifications *at all*, she must have surrendered the command of the sea, and, if such command has been necessary to her empire, *she must have abandoned empire.*" The italics are our own.

No, no. Admiral Colomb penned these remarks in righteous indignation at the audacity of Captain Stone, who, as he says, "made a sort of excursus into the domain of naval action and policy" when discussing the employment of "quick-firing guns for fortress defence." It will be remembered that in the columns of THE ENGINEER we recognised that very important "side issues" on naval questions were raised by Captain Stone; but, regarding the lecture as only a dissertation upon quick-firing guns, we did not review his opinions under the head of naval operations. It is, we consider, a proceeding to be deprecated when scientists of one profession plunge recklessly into dogmatic expressions of opinion upon the policy which should guide the conduct of other professions. The ancient aphorism in regard to the cobbler and his last is too frequently forgotten or set aside in these days of general adaptiveness. Hence, we conceive that it was somewhat unfortunate that Captain Stone should have permitted himself to be carried away from the legitimate aim and object of his most valuable paper upon quick-firing guns, into side issues, or, as Admiral Colomb calls them, "primary issues," of so vast a significance as high naval policy; and we cannot but regret that, at a time when the question of completing the chain of fortified links which engirdles the British Empire, and which is declared by experts to be essential to its coherence, comes upon the *tapis*, and is, so to speak, hanging in the balance, that any voice should be raised in the endeavour to embarrass those who are urging on the undertaking. We will not follow Admiral Colomb into all the intricacies of history which he has unravelled in support of his argument, further than to say that Colonel A. Parnell, in a recent number of the *Army and Navy Gazette*, discounts their value very considerably, by looking at the events from a landsman's point of view.

But, having dwelt shortly upon what we regard as merely the argumentative element in Admiral Colomb's lecture, let us now glance at the really important points which he so clearly enunciates. The most salient of these is the imperative necessity that for the preservation of our empire we must ever hold the command of the seas; and this condition involves supremacy, not only in the great seas, but unbroken command of the lines of communication all over the globe. At such a time as the present, when the contemplated increase of seventy battleships, cruisers, and gun vessels to our Navy, so as to make it equal to the navies of any two other Powers, is under consideration, the weight of Admiral Colomb's opinion is most judiciously thrown in on the side of her Majesty's Government. Looking at the matter from this point of view, the utterances in the lecture command more than ordinary interest, more especially as they were dictated by one who was ignorant of the intentions of the Admiralty, since communicated to Parliament. But one of the most valuable of all hints adduced by Admiral Colomb is that in which he professes to give the line of policy sketched by Colonel Maurice, as applicable to concerted action of the army and our fleet. Instead of shutting up the former in detached garrisons dispersed throughout the empire, he would employ it for embarkation under convoy of, and disembarkation under cover of the Navy, for *offensive action* against independent parts of the enemy's shores. Here we think that the weak point in all our policy has been probed. One hundred years ago we never assumed a defensive *rôle*. We carried our arms into the enemy's country at once, and swept down upon his ships and harbours with our squadrons. Admiral Colomb is altogether right when he indicates our true policy as an active one. Hence the great principles of his paper deserve to be printed in letters of gold.

JOHN ERICSSON.

MEN of genius are often over-rated by their countrymen, because they are at once valuable and exceedingly scarce. John Ericsson was in the fullest sense of the term a genius, and in the United States there is manifest just now a strong tendency to rate him at a higher value than he deserved. This amiable weakness does no one any harm, but it is just a little vexatious to find success after success claimed for him at the expense of Englishmen. That Ericsson was an excessively clever man we do not for a moment dispute; we use the word "excessively" advisedly, and of set purpose; none other could so well convey our meaning. Ericsson was too clever, and the fact really impaired his utility. The best way to illustrate this is to glance briefly at some of the events of his life, and to consider the claims made for him, claims, indeed, which he himself would possibly have repudiated. He was born in 1803 in a Swedish mining district, and was made a cadet in the Swedish Corps of Engineers when he was twelve years old. He was soon afterwards employed in taking levels for a section of the Gotha Ship Canal, and it is said that he was so small that a stool had to be carried for him on which he stood to reach the eye-piece of the level. One of his first inventions was a flame engine; what this was precisely we have never been able to learn. It was some form of caloric engine worked with pine shavings. He came to England in 1826, and got into partnership with John Brathwaite, and between them was designed and constructed a locomotive—The Novelty—in which the products of combustion traversed a tube winding backwards and forwards through the boiler; combustion was forced by a bellows worked by the engine. During the memorable Rainhill trials the engine competed for the prize, but the workmanship was so indifferent that the boiler broke down, and the machine was withdrawn. One of the great defects in Ericsson's character as an engineer was manifested here, namely, inattention to details. It appears, indeed, the invariable rule that a mechanical genius shall neglect detail, not only in construction, but in design; yet on detail depends all the difference between success and failure. We use the word, be it remembered, in a very large sense. How large will be understood as we proceed.

Ericsson about this time, and for some years subsequently, produced a host of inventions. It is claimed for him that he was the first man to use forced draught at sea in a steamship called the Victory, constructed in 1828. This ship had no smoke-stack. What was to become of the smoke after it was got overboard he does not seem to have cared. Yet it is sufficiently obvious that nothing was to be gained by suppressing the chimney, whatever might be the benefit of the forced draught. We need scarcely add that the value of the invention as it stood was practically nil. In a second ship, the Corsair, built at Liverpool in 1832, centrifugal fan blowers were employed, and we willingly give Ericsson the credit for an invention with a possible future. Ericsson was one of the first, if not the first, to construct a steam fire-engine, and in 1840 he took the gold medal of the Mechanics' Institute of New York for one. The United States claim that he invented the link motion, and applied it in 1830 to the King William and Adelaide locomotives. There is no basis, however, for the claim, Ericsson's valve gear being in no sense or way identical with that known as Stephenson's. In 1833 he produced his caloric engine. Very great things were expected of this invention, but it came to nothing. In the hands of English engineers the principle has been successfully applied on a small scale. Ericsson was quite unable, from lack of consideration for detail, to see that it could not be made to answer on a large scale. Money was available, however, and on a large scale it was tried on board the Ericsson, a ship 260ft. long, built specially for the purpose. She was fitted with paddle-wheels driven by four cylinders, each 14ft. in diameter, with a stroke of 6ft. The number of revolutions made per minute was nine, and the indicated horse-power of this huge machine was only 300 horses, the effective pressure being, according to Rankine, only 2·12 lb. per square inch. It is said that during the trial trip a man was kept in each cylinder—they were open-topped—and well supplied with buckets of melted tallow, with which he lubricated the sides of the cylinder. He stood on the piston and went up and down with it. It was only a detail that the use of hot air was incompatible with any efficient system of lubrication, and that the fires were lighted under the cylinder bottoms—a way of heating the air as inefficient as possible. The engine, however, notwithstanding its unwieldiness, might have achieved a certain measure of success if only the lubrication could have been managed. The ship was altogether too slow for commercial purposes,

and Ericsson had the caloric engines taken out and replaced with steam.

The greatest claim set up for Ericsson is that he invented *the* screw propeller. Of course, it is well known that he did nothing of the kind. He did invent *a* screw propeller, and a very good one, and very great credit is due to him for the pertinacity with which he insisted that the screw would be invaluable for ships of war. It is noteworthy that after he had proved to the Lords of the Admiralty that a screw propeller could work, their lordships condemned the whole thing, because they asserted that a ship with a propeller at the stern could not be steered. Ericsson was so vexed that he left England and went to the United States. His friend, Commodore Stockton left no stone unturned to induce the United States naval authorities to build a ship from Ericsson's designs. After two years the Princeton was ordered. She was fitted with rocking piston engines designed by Ericsson, and so well designed and so well made were they, that when the hull of the Princeton was worn out they were removed and a new vessel was built for them. It might be imagined that the construction of such a war vessel as the Princeton would involve novelties enough, even if she were fitted with ordinary guns. But that was not Ericsson's opinion, and he had huge guns made for her. Whether these guns would or would not bear to be fired was a detail. The Princeton was finished early in 1844, and on February 20th in that year, John Quincy Adams wrote thus in his diary:—"The House of Representatives yesterday adjourned over until to-morrow on the motion of Isaac E. Holmes, member for South Carolina, for the avowed purpose of enabling the members to visit the Princeton, a war steamer and sailing vessel combined, with the steam machinery of Ericsson's propellers, all within the hull of the vessel and below the water line, and carrying twenty-four 42 lb. carronades, and on her main deck two enormous wrought iron cannon, with barrels of 14in. diameter, chargeable with 40 lb. of powder, and discharging a ball of 225 lb. weight. This vessel, a gimcrack of sundry other inventions of Captain Stockton himself, was built under his directions, and is commanded by him. She was ordered round here to be exhibited to the President and heads of the executive departments, and to the members of both Houses of Congress, to fire their souls with patriotic ardour for a naval war." On the 28th of the same month he wrote:—"I went into the chamber of the Committee of Manufactures, and wrote there till six. Dined with Mr. Grinnell and Mr. Winthrop; Mr. Pakenham—the new British Minister—and his secretary—Mr. Bidwell—were there. While we were at dinner, John Barney burst into the chamber, rushed up to General Scott, and told him, with groans, that the President wished to see him; that the great gun on board the Princeton, the 'Peacemaker,' had burst, and killed the Secretary of State, Upshur, the Secretary of the Navy, T. W. Gilmer, Captain Beverly Kennon, Virgil Maxey, a Colonel Gardiner of New York, and a coloured servant of the President, and desperately wounded several of the crew. General Scott soon left the table; Mr. Webster shortly after; also Senator Bayard. I came home before ten in the evening." Notwithstanding the failure of the gun, the Princeton reflects infinite credit, not only on Ericsson, but on the public spirit of the builders.

Ericsson's greatest invention was, however, the Monitor. It is impossible to over-rate the service which the original Monitor, built in 100 days, rendered to the Federal Government in a time of the utmost peril. No one but a genius could have invented and designed such a ship, and we should be the last to say a disparaging word, were it not that extravagant claims are now being made on the other side of the Atlantic. The United States *Army and Navy Journal* says:—"The Monitors were speedily adopted by Ericsson's native country, Sweden, by Norway, and by Russia. England, with stubborn incredulity, long refused to believe that there was anything worthy of acceptance in this latest Yankee notion. It was not until the double turretted Monitor Miantonomoh presented herself in English waters in the summer of 1866—more than four years after the appearance of the original Monitor in Hampton Roads—that British public opinion finally yielded." The opinion of experts in this country never yielded. England never built a Monitor, nor did France, nor Russia, nor any other country save the United States. The Monitor was a craft *sui generis*, and must not for a moment be confounded with turret ships, which if they were invented at all by any single individual—which we doubt—were invented by Captain Cowper Coles. The Monitor answered its purpose for the time, but no Monitors are built now. As seagoing ships they are entirely useless. The idea involved in their construction is captivating. They mount tremendous guns. They offer a minute mark to an enemy. They have a steady gun platform, and can be well protected; but when we have said this we have said all that can be said. They are execrable seaboats. It is impossible for a crew to live any time on board them. They are very slow, and in anything like a sea their guns cannot be fought. In every necessary detail they are utter failures, and the success they achieved during the American War was attained in still water, and only because they had no adequate foe to contend against; but they were novel and ingenious to the last degree. They could not have been invented by a sailor, because he would know too much. Ericsson's combination of ignorance and genius happily resulted in the production of a craft which was just the thing for its intended purpose. Every credit is due to him so far; but to claim that he in any way left a permanent mark on naval construction is little short of absurd, and is not at all short of being injudicious. To show how far adulation can be pushed, we quote the following lines from the New York *Army and Navy Journal*:—"Although these works are usually referred to as inventions, it should be remembered that Captain Ericsson objected, and with reason, to the title of inventor, a designation more properly belonging to men endowed with fertile genius but lacking rudimental knowledge, and in most cases ignorant of the first principle of mechanics. Ericsson's knowledge, on the contrary, embraced the entire range of mechanical philosophy. He was also a profound geometrician, and possessed greater practical experience as a mechanical constructor than any living man." Writing of this kind does harm instead of good to a reputation. We are of those who hold that Ericsson was a most remarkable and original genius; but we do not hold that he was, in the proper sense of the term, a great engineer. Nearly everything that he produced was ephemeral in its character, and necessarily so, because it lacked that combination of qualities which is essential to the longevity of an invention. Only the fittest inventions survive—and Ericsson's products were not the fittest. His screw propeller, for example, was admirable simply regarded as a propeller, but it was not admirable as an appurtenance to a ship; not nearly so good a propeller as that ultimately produced by Smith, who worked out his invention rather before Ericsson, and who really did far more to promote screw propulsion than Ericsson did. But Smith was a man of one idea—a Hendon farmer interested all his life in boats. As a genius he could not compare for a moment with the Swede; but that did not prevent him from inventing a much better method of propelling ships. Sweden may well be proud of her son. Any nation would be justified in boasting that such a man was born within her shores; but truth and justice must be respected, and it is well not to forget that it is very difficult to put forward the magnificent claims now made for Ericsson without sacrificing the truth and depriving others of the credit justly due to them. The assertion that to Ericsson is due steam navigation by screw propulsion is more than the average English engineer or naval architect, or shipowner, will accept without a protest. For Ericsson's abilities we have always had the highest respect. Fulsome adulation of his memory certainly cannot originate in a correct appreciation of his mental powers, and will tend rather to hurt than to raise his reputation. The man himself, if alive, would probably be the first to condemn such utterances as those we have quoted.

RAILWAYS AND RATES.

Though much is heard of railways and rates, there is one aspect of the question of vital interest which seems little noticed. It is that of the rates which railways pay to the parishes and municipal districts they pass through. Few have any conception of the amounts that are paid in this manner by the chief railway companies, and it may be interesting to give one or two instances. In rates and taxes, the London and North-Western Railway paid in the last half of last year no less a sum than £167,493, or close upon £1000 daily. The North-Eastern Railway paid for rates and taxes for its last half-year, £100,633; and the Great Northern Railway paid £54,482. In the latter case close upon 3 per cent. of the gross receipts of the company were paid for rates and taxes; and in the case of the London and North-Western Railway it is rather above that proportion. Another fact in relation to these enormous sums is that the total increases from year to year. In a few years the sum paid by the companies in this way has been doubled, and the increase is still continuous. It is one of the most unsatisfactory items of railway expenditure; it is one as to which there is the most continuous complaint; and it is one which few of the boards of directors seem inclined to prevent the growth of by practical steps. Now and then a railway company appears before an assessment committee, by some of its officials, and urges objections to the amount it is to be rated on; but it is obvious that this can have only a partial and limited effect. At two or three of the recent railway meetings attention has been drawn to the increase of railway rates, and the idea has been thrown out that it is the duty of the shareholders locally to check that growth. There may be something done in this manner, but it would be much more effectively done if the power of the railway companies was given to it. For instance, when application is made for additional loans to boroughs and allied institutions the railways should oppose these, and insist on the expenditure of the day being met out of the rates of the day, instead of an ever-increasing local debt being allowed to accumulate, which swells the sums paid for interest despite all efforts, and necessarily causes an increase of the rates, and consequently of the amounts paid by the great contributors. It is by the bringing of the vast power of the railway companies to bear on the smaller town and rural authorities that the railways can not only speedily lessen the sums they pay for rates and taxes, but they can also benefit the smaller payers, who are now burdened with that continual growth of the local taxation. The subject is one which the companies will have to take up and seriously consider soon, and the earlier that they devote themselves to the task the better will it be for them. The national debt is being reduced, but there is growing, and that with rapidity, a local indebtedness which has slight supervision, and which is becoming a costly and an ever-increasing burden to the great carrying companies, which derive very slight benefits indeed from the expenditure.

STEAM USERS AND THE PROPOSED COAL RING.

Steam users have not much to fear from the proposed coal syndicate. The idea, so far as the figures have as yet been published, is decidedly imposing, but its successful working out may be regarded as very improbable. In the first place, it is doubtful whether the £100,000,000 suggested would buy up all the lessees' interests which it is proposed to acquire. In the next place it may be noted that in a combination of this sort everything depends upon a complete union, and if some of the fields stand out, that is quite sufficient to seriously damage the scheme. The project so far has not been taken up at all unanimously by the coalowners in the various districts which are affected by the proposed scheme, and these comprise Scotland, Durham, Northumberland, Wales, Derbyshire, Yorkshire, Lancashire, and Cheshire. In one or two districts it is regarded as utterly impracticable, and South Wales at present declines to join. Yorkshire gives only a qualified support, and at the recent meeting in London it was noticed that the principal coalowners of South Lancashire and Cheshire were conspicuous only by their absence. An inducement is offered in the way of a hope held out that after providing the necessary reserve for further sinking and deeper workings, interest of the debentures, and a dividend of 10 per cent. on the shares, then the balance shall be applied to the benefit of the consumer by the reduction of the selling price. It would probably be a long time before these conditions of a promised reduction came about. It is not so hard a matter to "corner" commodities of which the possible production is known, but to "corner" coal of which the possible production is—notwithstanding sundry startling estimates as to a probable early scarcity of fuel—as yet quite an unknown quantity, is a task beyond the power of the proposed association, or of any other body. If prices are not to rise, then it were useless for colliery owners to combine. Once let prices rise to a point profitable to the members of the syndicate, and immediately their foreign if not their home markets will be taken from them by other countries. We regard the proposed coal syndicate as Utopian. If formed, it will collapse like the copper ring. Steam users have nought to fear from it.

THE NEW DEVELOPMENT IN THE COAL TRADE.

Yorkshire miners have committed themselves to the movement for another advance in wages. This was not done without much deliberation. The Council of the Yorkshire Miners' Association sat for over eight hours, listening to the reading of reports and hearing the views of the men at the various branches with regard to the proposed "hoisting up" of prices. A strong deputation was appointed to attend the Miners' Conference, which opened its sittings at Birmingham on Tuesday, and were instructed to support a proposition to be there submitted for a 10 per cent. advance. It is expected that the new demand will be obtained more easily than the old one. If the miners are not too precipitate in their action, the request will come at a much more seasonable period than the last. The great bulk of the coal raised in Yorkshire is consumed by the railway and gas companies, with whom contracts are made for twelve months. These will expire at the end of June, and the new contracts will have to be made in view of the increased cost of coal-getting. There is little doubt that the large consumers have long had control of the coal trade. They have practically made their own terms with the coalowners, and the colliers have been compelled to work at wages in accordance with the low value of the commodity they were engaged upon. Even railway and gas managers could scarcely expect this to continue, and there seems every reason to anticipate that the swing of the pendulum is now in the other direction. Rails and gas have had a long innings. It is at length the turn of the coalowner and the coal-getter, and the Birmingham Conference is more likely to secure better values for fuel—which means profit to colliery investors and fair wages for colliers—than any striving after huge coal syndicates, which are too gigantic to grapple with.

LITERATURE.

Practical Geometry for Science and Art Students. By John Carroll, Art Master, Hammersmith Training College. Tenth edition. London: Burns and Oates.

This is by much the best book we have seen on the subject, in design, in completeness, and in arrangement. It is satisfactory to find that it seems to be fully appreciated, having passed into its tenth edition in eight years from its first publication. It is stated on the title-page to have been approved by the Science and Art Department, and adopted by the London School Board. The author's experience as a teacher has no doubt been turned to good account in its fulness of matter, there being fully 600 problems and exercises, and in its arrangement. The design of the book, however, has a special character, somewhat new to us in practical treatises, and worthy of very special notice, which is that there is no desire to slur over the theoretic basis of the subject. We are accustomed in books of the kind to find principles introduced as seldom as may be, and, where unavoidable, put as inconspicuously as possible, often in a foot-note, so as to lead the student to regard them as beyond his province. In this treatise, on the contrary, theoretic principles form the basis of the work. The subject is divided into lessons, each of which is headed by some important geometrical truth, which the problems of the lesson illustrate and enforce. Problems are thus not isolated efforts of memory, but bound together as deductions from principles; the latter are assigned their due importance, and there is consequently an inducement to the good student to follow them up to their source. The arrangement by which the lessons occupy the left-hand page of the book, with the necessary diagrams on the right, is extremely convenient and, so far as we know, original. The book is, however, doubtless very well known. Its language is clear, terse, and accurate. A note in the preface to this edition states that lessons have been added on areas, orthographic projection, and "graphic" arithmetic. The last somewhat novel title signifies the representation of numbers by lines, and their multiplication, division, involution, and evolution by construction.

The Coming Oil Age. By Charles Marvin. R. Anderson and Co., London. 1889.

This remarkable little pamphlet of thirty-two pages contains some very interesting information with reference to the petroleum industry, the most valuable of which is the section devoted to tank steamers, in which Swan's "conical bottom" tank steamers are described and illustrated. These consist of a series of tanks divided by a longitudinal bulkhead, resting on a conical-shaped water-ballast bottom. This causes the oil tank to slope into a trough, from which the oil can be completely drained with the greatest ease. If the tank should leak, it could only leak through the skin of the ship into the sea, or into the conical-shaped water ballast way running along the ship's bottom, a water compartment along which a man could walk upright from end to end. Should any leakage take place into this conical compartment, all that need be done is to fill it with water; the oil then floats to the top of the water, and travels up with it trunkways, running from the conical compartment to the deck, whence it flows overboard. In this manner every drop of leakage is effectually secured and expelled, and all accumulations of oil gas prevented, so that no explosion can occur.

Mr. Marvin predicts that oil will supersede gas as an illuminant, but does not refer to the importance of petroleum as a fuel, nor to the great advantages derived from its use in the manufacture of steel and iron. Although he refers to several new oil regions, especially those in Canada, Burmah, and Galicia, he does not say a word about the vast oil fields of Venezuela, which lie along its northern coast and round Lake Maracaibo, and are situ-