blow of the rock drill is similar to that of the steam-hammer. *Ex pede Herculem!* It appeared, however, that the makers of the machines framed the conditions of trial, so that, presumably, every one concerned was satisfied.

## THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meeting of the Institution of Naval Architects was held last week, on Wednesday, Thursday, and Friday, at the rooms of the Society of Arts, lent by the latter Society for the purpose. The meeting in question was one of the most successful held for many years; the merit of the papers and the large attendance of members speaking volumes as to the flourishing state of this excellent Society. As there were just a dozen items in the programme, including the President's Address, it will be evident that we can do no more than mention some of the papers read.

The one fault we have had to find in the management of this Institution is that it gives us too many good things at once. It holds but one meeting a year, and that is divided into five sittings. In this way matters that would supply a whole season's programme for many kindred institutions have been crowded into the sole meeting of the year, which has to be rushed through in three days. We have dwelt on this subject before, and know for a fact that our remarks have met with the approval of a considerable number of members. We are glad, therefore, to learn that it is proposed in future to hold two meetings every year. If an effort is made by the Council to improve the quality of the discussions—which can only be done by giving them more time—rather than by adding to the number of papers, the new departure will, we feel sure, be additionally welcome.

The following is a list of the papers read and discussed:—1. "Future Policy of War-ship Building," by Lord Brassey. 2. "On some recent American War-ship Designs for the American Navy," by J. H. Biles. 3. "On Boiler Deposits," by Prof. Vivian B. Lewes. 4. "Study of Certain Phenomena of Compression," by M. Marchal. 5. "Boiler Construction suitable for withstanding the Strains of Forced Draught," by A. F. Yarrow. 6. "Recent Improvements in Armour for Vessels," by M. Barba, Chief Engineer of Schneider and Co., Creusot. 7. "On the Alteration in form of Steel Vessels due to Different Conditions of Loading," by Thomas Phillips. 8. "The Internal Stresses in Steel Plating," by J. A. Yates. 9. "Certain Details of Marine Engineering," by Thomas Mudd. 10. "On Combined Crank, Crank and Intermediate Shafts, for Marine Engines, and on their liability to Fracture," by C. H. Haswell. 11. "An Assistant Cylinder for Marine Engines," by David Joy. The President, Lord Ravensworth, occupied the chair throughout.

The two great features of the meeting were undoubtedly Mr. Yarrow's paper on boiler construction, and Lord Brassey's contribution on war-ship policy. The respective values attached to these memoirs naturally depended on the walk in life of those appraising them; the Admirals mustering in unusual force to hear Lord Brassey, whilst there was a tremendous gathering of engineers to listen to Mr. Yarrow; indeed, we have seldom seen the theatre in John Street more crowded than it was last Thursday. Each of these papers had an addendum, Lord Brassey's in Mr. Biles's contribution, and Mr. Yarrow's in Mr. Mudd's paper, which gave some very valuable practical additions to our knowledge of the science of boiler construction.

We have used the term "science of boiler construction" advisedly. Last week we should have hesitated to apply it, as being a subject almost non-existent. Steam engineers have woefully neglected the source of their power in time past. The engine has been like a favourite child, no trouble too great to expend upon it; but the boiler has been, figuratively speaking, left out in the cold. Such improvements as have been made in its construction have been due to inventive ability of the ingenious mechanic order. Hardly anyone has thought of treating the boiler philosophically; at least hardly any one before Mr. Yarrow. The boiler has had its revenge. It has been the uncertain factor, and, in marine engineering, the prime source of trouble. We wish we could give all the beautiful experiments by which Mr. Yarrow illustrated the reason of the ills to which boilers are subject when they are pressed to a high rate of duty. Everyone has heard of the difficulties that have arisen in our own and foreign navies from the endeavour to apply forced draught to war-vessels. The curious fact has remained that whilst time after time the larger vessels of the navy came back from abortive trials with boilers leaking at every tube, Mr. Yarrow could run the trials of his torpedo boats, having a high forced draught pressure, with almost unvarying success. The prime reason for all which was made apparent by the paper of Thursday evening last. It may be explained in a few words: Mr. Yarrow has treated his subject in the true spirit of scientific research. He has taken each difficulty as it arose, and investigated it to the bottom, dealing with material he had to use, and the method of construction, upon a basis of scientific reasoning. A good example of this was shown in the manner in which he explained the ovalling of tube plate holes, one of the most fruitful sources of trouble to those who run marine boilers with forced draught. Mr. Yarrow first gathered together all the known facts on the subject. He took the two metals of which tube plates are composed—namely, copper and steel—and tabulated their rates of expansion under various temperatures, and their ratio of conductivity of heat. By the facts so ascertained, and the analogy of a well-known blacksmith's operation—that of reducing the size of a tire by repeated heatings and coolings on one side only—he formulated certain hypotheses, which he proved by experiment to be well founded. His reasoning was clearly set out in his paper, and his experiments were successfully repeated before the meeting. The conclusions involve some interesting problems of molecular physics, and we regret we cannot give the matter the space it deserves; but a satisfactory explanation would involve the reproduction of Mr. Yarrow's diagrams and illustrations of his apparatus. We have dwelt somewhat at length on this paper, partly because it is likely to be of especial interest to our readers, but more especially because it affords a most welcome precedent which we hope many other principals of engineering factories will follow.

Turning to the other papers, we find them all at least of moderate merit, and many of them excellent. Mr. Phillips's contribution on the alteration in form of steel vessels was a praiseworthy effort to put an important branch of ship construction on a more satisfactory basis. From his exceptional position he was able to carry out a series of practical investigations as to the alteration of form of ships under certain conditions of stress, which are so far satisfactory that they go to prove the existing regulations in force on this subject are sufficient. The paper did not pass without criticism, and indeed gave rise to one of the best discussions of the meeting. The paper of Mr. Yates was a more philosophical effort on a cognate subject. A consideration of the internal stresses in steel plating due to water pressure involves some very debatable matter, and the author's mathematics did not pass without criticism. It is characteristic of the time that Mr. Bryan, whose admirable paper on the buckling of a thin steel plate will be remembered, journeyed up from Cambridge purposely to speak on this paper. His mathematical analysis of the subject will form a valuable page in the Transactions.

Prof. Lewes's paper on boiler deposits was eminently practical, and a most welcome addition to a too little studied subject. The Institution and the engineering world in general are fortunate in getting a competent chemist to turn his attention to these matters. M. M. Marchal's paper was taken as read. The paper by M. Barba was somewhat disappointing, and the discussion which followed it was decidedly "shoppy." The two remaining papers which were read, those of Mr. Mudd and Mr. Joy, were of a practical engineering interest; more especially Mr. Mudd's, which was full of instruction for working marine engineers. Mr. Haswell's contribution was not read.

## SCIENTIFIC SERIALS.

*American Journal of Science*, March.—On gold-coloured allotropic silver, by Mr. M. Carey Lea. The present paper is in continuation of one published in this *Journal* in June 1889, and has for its object the description of the reactions of gold-coloured allotropic silver. It is shown that there exists a well characterized form of silver, intermediate between the allotropic silver previously described and ordinary silver, differing in a marked manner from both. All forms of energy act upon allotropic silver, converting it either into ordinary silver or into the inter-



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mediate form. Mechanical force (shearing stress) and high tension electricity convert it directly into ordinary silver. Heat and chemical action convert it first into the intermediate form, then into ordinary silver. The action of light is to produce the intermediate form only, and even the most prolonged action at ordinary temperatures does not carry it beyond this. A remarkable parallelism appears to exist between the action of these forms of force on allotropic silver and their action on the silver haloids, indicating that it is not improbable that in these haloids silver may exist in the allotropic condition. Three coloured plates accompanying the paper illustrate the changes described.—The flora of the Great Falls coal-field, Montana, by J. S. Newberry.—High-level shores in the region of the Great Lakes, and their deformation, by J. W. Spencer.—On the composition of pollucite and its occurrence at Hebron, Maine, by G. H. L. Wells.—The volumetric composition of water, by Edward W. Morley. A description is given of the apparatus used to obtain results which will be published in the next number.—On the intensity of sound: a reply to a critic, by Charles K. Wead.—The fire-ball in Raphael's "Madonna di Foligno," by Prof. H. A. Newton. The fire-ball painted by Raphael in his picture, the "Madonna di Foligno," is most probably representative of one that fell at Crema in September 1511. Some political events of importance to Italy and the Pope, which transpired in 1512, were supposed to be connected with the fall of stones that occurred. It appears natural, therefore, that Raphael should introduce the Crema fire-ball into the altar-piece he was painting at the time.

*Reale Istituto Lombardo*, December 4, 1890.—Observations on the results of mechanical and chemical analyses of some soils in the neighbourhood of Pavia, by Prof. T. Taramelli.—The mean linear coefficient of expansion by heat, between the limits of temperature 0° and $t$°, of a homogeneous and isotropic solid body, is inversely proportional to the difference which exists between the temperature of fusion T and the temperature $t$, by Prof. A. Sayno.—On the dynamics of storms, by Prof. L. de Marchi.—On the classification of rational transformations of space, and in particular on transformations of the zero class, by Signor G. Loria.—Note on the calcite of some localities in the Grand-Duchy of Baden, by Prof. F. Sansoni.—On a theorem of differential geometry, by Prof. G. Padova.

December 18, 1890.—The coefficient of elastic expansion of a homogeneous and isotropic solid body at a temperature $t$, between two given limits, is inversely proportional to the difference which exists between the temperature of fusion T and the temperature $t$, by Prof. A. Sayno.—On some ancient and modern lavas from Stromboli, by Prof. G. Mercalli.—General formulæ for the representation of a field of force by means of elastic tension, by Dr. C. Somigliana.

January 15.—On the theory of the potential function of surfaces, by S. C. G. A. Maggi.—Results of observations made at the Royal Observatory at Brera during the years 1889-90.—On the diurnal variation in magnetic declination, by M. E. G. V. Schiaparelli. It is shown that the magnitude of the diurnal variation in magnetic declination is connected with the amount of spotted surface on the sun as exhibited by Wolf's relative numbers.—On calculations of condensation and on some applications of them, by E. Cesaro.

*Notes from the Leyden Museum*, vol. xii., No. 3, July 1890, contains:—P. C. T. Snellen, note on *Tyana superba*, Moore.—C. Ritsem, on *Cyriocrates zonator*, Thoms.—Ed. Lefevre, new Coleoptera belonging to the Eumolpidæ.—Dr. W. van Lidth de Jeude, on a large specimen of Orthragoriscus washed ashore at Ameland. The specimen is figured, and attention is called to discrepancies in the published descriptions and figures.—M. Schepman, on *Oliva semmelinki*, n.sp.—J. Büttikofer, zoological researches in Liberia; birds collected in the district of Grand Cape Mount. *Zosterops demeryi* and *Z. obsoleta* described as new, and eighty-six species enumerated.—W. Roelofs, *Ectatorhinus alatus*, n.sp., described.

No. 4, October 1890, contains:—J. D. Pasteur, on telegraph poles pierced by woodpeckers (*Picus analis*).—Dr. F. A. Jentink, on *Strepsiceros kudu* and *S. imberbis*, rectifies several mistakes made by various authorities about these species.—On two very rare, nearly forgotten, and often misunderstood Mammals from the Malayan Archipelago, *Pithecia melanurus*, S. Muller, the history of which species is quite a romance; but as facts it may be stated that it lives in Sumatra and West Java, that Duvaucel's drawing (reproduced in F. Cuvier's "Histoire naturelle des Mammifères") represents the animal of its natural size, that it has been accurately and satisfactorily drawn, and, finally, that the animal is a true mouse. Two specimens are in the Leyden Museum. *Tupaja dorsalis*, Schlegel. Dr. Jentink justifies Schlegel in keeping this as a species distinct from *T. tana*, contrary to the opinion he expressed in 1888.—On *Rhinoceros simus*, Burch. The Leyden Museum possesses a fine stuffed adult female, and an unstuffed skin of this species. Quotations are given from modern writings, which suggest that the species is not so rare as Dr. P. L. Sclater seemed to think (NATURE, vol. xlii. p. 520). The question is asked, Is the Quagga extinct? If so, it would be well to take stock of the existing specimens.—Dr. R. Horst, on *Perichæta vordermanni* and *P. sluiteri*, new species from the Island of Billiton.—W. Roelofs, on two new species of Poteriophorus, *P. van de polli*, and *P. sellatus*.—E. Candeze, *Melanoxanthus nigrosignatus*, n.sp., Java.—C. Ritsema, *Coloborhombus auricomus*, Java; *Thermonotus pasteuri*, Sumatra; and *Atossa bipartita*, Borneo, all described as new species.—Dr. de Jeude, on some reptiles from Nias.

Vol. xiii., No. 1, January 1891, contains:—Dr. J. G. de Man, carcinological studies in the Leyden Museum (plates i. to iv.). This is No. 5 of a series of studies. Several new species are described, a conspectus of fifteen Indo-Pacific species of the genus Gelasimus is given.—M. Schepman, *Fusus sieboldi*, n.sp., from Japan.—A. B. Meyer, *Cercopithecus wolfi*, n.sp., a beautiful species from Central West Africa, living in the Dresden Zoological Gardens.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, March 5.—"Some Points in the Structure and Development of Dentine." By J. Howard Mummery. Communicated by C. S. Tomes, F.R.S.

The purpose of the present paper is to show that there are appearances in dentine which suggest that it is formed by a connective tissue calcification, and that the process is more closely analogous to the formation of bone than has usually been supposed.

Processes or bundles of fibres are seen, incorporated on the one side with the dentine, and on the other with the connective tissue stroma of the pulp; some of the bundles give evidence of partial calcification, reminding one of similar appearances in the calcification of membrane bone. Cells are seen included in the bundles and lying parallel to their course; these cells, it is concluded, forming with the odontoblasts the formative cells of the dentine, the calcification of which should be looked upon as in part, at least, a secretion rather than a conversion process, the cells secreting a material which calcifies along the lines of and among the connective tissue fibres, the cells themselves not being converted into dentine matrix. These appearances are seen in the rapidly forming dentine of a growing tooth, as well as in more fully developed specimens. An examination of other Mammalian teeth reveals similar appearances. The dentine of the incisor of the rat (*Mus decumanus*) shows with great distinctness the incorporation of the connective tissue fibres with the dentine, and a marked striation of the dentine near the pulp cavity, parallel with these fibres. The ivory of the elephant's tusk shows the same relation of connective tissue to formed dentine. Vaso-dentine exhibits a very well defined connective tissue layer surrounding the pulp. This layer has hitherto been looked upon as consisting of odontoblasts, but this tissue shows no nuclei, and has the characters of a layer of flattened connective tissue fibres—a layer of nucleated cells in close apposition to the dentine, probably being the odontoblasts of vaso-dentine.

**Physical Society**, March 6.—Prof. W. E. Ayrton, F.R.S., President, in the chair.—Mr. James Swinburne read a note on Electrostatic wattmeters. After referring to the history of the electrometer method of measuring power developed by alternating currents, the author pointed out that the necessity for taking two readings from which to determine the watts might be obviated by having the quadrants separated instead of connected in pairs, as in the ordinary method. Non-inductive resistances are connected to the transformer, motor, or other apparatus in which the power is to be measured, so as to be in series with the apparatus, and on opposite sides of it, and the four ends of these two resistances are connected with the four quadrants. Under these circumstances the deflection of the needle is a measure of



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