of paper, is apt to lose its purity and acquire confusing lines and bands of ordinary copper-chloride, by oxidation, which the preparation then undergoes spontaneously, before igniting it. For pyrotechnists, therefore, it seems scarcely probable that the subchloride of copper, with its pure cerulean flame, will ever be of any very useful value. But as a parallel example of a coloured-fire composition, it may be mentioned here, that powdered Val-Traversite (a bituminous limestone found near Neuchâtel, in Switzerland), on account of its prodigious natural richness in bitumen, when mixed with sufficient chlorate of potash, also burns self-supportingly, with a fine orange-red flame in which the familiar spectrum of calcic oxide is, of course, most vivid. Were hot asphalt, pitch, or bitumen, instead of hot glycerine, used to dissolve or to "masticate" the dry subchloride of copper when it is freshly made, a copper-chlorinated mass would be produced which would probably be capable of resisting atmospheric action, and whose mixture with chlorate of potash would, like the similar Val-Traversite mixture, probably also not suffer by keeping and exposure, and would furnish a source of blue flame and of the significantly simple spectrum of subchloride of copper, not less vividly true and fixed in their distinctness, than the orange-red light and strongly pronounced calcic-oxide spectrum of the other combination of chlorate of potash with a bitumen-containing substance.

As regards the blue salt-flame, whose spectrum in its purity shows no conspicuous lines, or bands of greatest brightness, it can hardly be doubted that the element chlorine, from the positions of its own principal line groups, contributes mainly to produce the blue coloration, at a temperature, in the fire, which is not high enough to dissociate the sodic chloride and liberate sodium vapour, with its tell-tale yellow line, from its chemical union. In the green flame of chloride of copper the colouring groups of lines show a more detailed resemblance than this to the chief colorific lines in the elementary chlorine spectrum,¹ while in copper subchloride's "bluest of blue" flames, the wide green light-bands of copper chloride fade out, leaving the colorific light concentrated almost entirely in three close pairs, or in six bright lines, which, if they do not coincide in place with, are at least not far distant in position from, three chief

¹ A very suggestive example of a substance's detection by recognition of its spectrum was described, with a drawing of the recorded spectra, by Mr. A. Percy Smith, in a short notice of a series of observations on the spectra of chlorides, and on the blue flame of common salt, in the *Chemical News*, vol. 39, p. 141 (1879). An examination of the flame-spectra of several different chlorides, enabled the author of that notice to recognize a common similarity among them all to the spark- or flame-spectrum of hydrochloric acid gas. This gas showed a belt of green line-bands which agreed in their main positions with the green portion of a long array of band-pair shown with much constancy by several different alkali and earthy chlorides, and especially by ammonium chloride, and by mercurous chloride (or calomel, where the agreement was also verified by a direct comparison), in a Bunsen flame; but no line-counterparts to the equally bright, blue-lined portion of the same constant spectral striation were observable in the hydrochloric acid spectrum.

From the easy conversion of chlorides into the corresponding oxides in a air-gas flame, when the flame is not kept artificially saturated with hydrochloric acid gas, we might pretty certainly assume that in the flame's ordinary condition, the heated chlorides would always disengage sufficient chlorine to produce by combination with hydrogen in the coal-gas of the flame, traces of the stable product, hydrochloric acid gas, among the gases of the flame's combustion; and the different chlorides would thus, by suppositions which may not perhaps be unlike any and in a missible, all supply the flame alike with the substantial factor needed, for the appearance of the green line portion of the constant spectrum.

At the same time new carbon-compounds would be formed by dehydration of the flame's gaseous hydrocarbons, to furnish hydrogen to the liberated chlorine, and some constant carbon-gases then, of not yet known descriptions, might be conjectured just as comprehensibly and fully, to be concurrently productive in the constant chloride-rank's illumination, of the blue-line portion of its bands, of which no spectral counterparts could be detected in the hydrochloric acid spectrum.

But whether the interesting figure and description given by Mr. A. Percy Smith in the above paper, of his long series of experiments, may or may not admit of such a simple spectro-chemical interpretation, the conflicts of contending chemical affinities of which the spectroscopic recognition of hydrochloric acid in flames fed with different chlorides furnishes such a wonderful example, give weight and value to the notes of the discovery recorded by Mr. A. Percy Smith, in a new wide field of the spectroscopy's utility, which are of much deeper interest than any single theory to account only for this particular recognition and discovery itself.

Mr. A. Percy Smith's own capitally based, and clearly proved deductions from his numerous experiments, were accordingly, in prospect of their further prosecution, expressed thus, quite generally:—that the blue flame of common salt in a hot fire owes its coloration to reactions either exactly or very nearly similar to those which produce resemblance of a nearly constant spectral type in different chloride flames, to that of hydrochloric acid; and that, again, among the partly undetermined, and perhaps to some extent variable reactions which produce the similarity, there appear to be some which disturb and modify the ordinary appearance of the hydrochloric acid spectrum, and which would appear to superadd to it a series of blue line-bands which, as it is presented in a flame, or electrically in vacuum tubes, the spectrum of pure hydrochloric acid gas alone does not usually exhibit.

line-pairs in the ordinary spectrum of chloride of copper. There is much in these resemblances which betokens some kind of continuity of connection with the primary features of the chlorine spectrum itself; the evidences of which, although thus displayed by copper and chlorine in the spectroscopy, may perhaps be sensibly regarded as having some near relation of analogy to the appearance of variable chemical combining power under the influence of light, between silver and chlorine, presented in photography. But there is also, undoubtedly, a very marked distinction between the "spectroscopic reactions" of these two different copper chlorides; and, similarly, there are in the apparently mutable photochemical affinity between silver and chlorine in photography, two fairly stable delimitations of its range, in the "subchloride" (or as it has been termed by Mr. Clement Lea, the "photochloride") of silver, and in ordinary silver-chloride. Further discriminations of the copper-chloride spectra in intermediate forms which they seem to comprise transitionally between the two definite ones of the chloride and subchloride, would perhaps extend and strengthen this analogy, and may not impossibly help, at some future time, to explain and illustrate it, if there is any real soundness in it, more fully and completely.

The example of fluoride of calcium is a curious one in spectrum analysis, where sprinkling fluor-spar dust in a Bunsen-flame produces, in addition to the normal calcic oxide spectrum of one orange-red and one green band, a second bright and narrow green one at a distance from the first about equal to that of the red band from it. There are no other distinguishable bands. But if the pair of normal ones is really due to calcium-oxide vapour produced by decomposition in the flame, it is not very easy to conjecture to what other product of decomposition the additional, sharply defined and brilliant, solitary green band can be ascribed. The spectrum of hydrofluosilicic acid gas presents a very gorgeous band-array of violet-blue lines, whose lustrous group is probably indicative of near neighbourhood in place to some bright line concentration in the spectrum of fluorine itself; but if so, the collection of its colorific strength in the single additional green line of the fluor-spar spectrum, seems to imply a freedom from uniformity in fluorine's power of imparting spectral coloration to its compounds, just opposite to the sensible continuity and kinship of spectral clusterings, above described, which the presence of chlorine appears to impose upon its compounds by common resemblances discernible in the blue light-absendencies of the fire-flames of common salt, chloride and subchloride of copper, when they are spectroscopically analyzed.

A. S. HERSCHEL.

Observatory House, Slough, March 3.

Brush-Turkeys on the Smaller Islands North of Celebes.

THE reviewer of Dr. Hickson's book, "A Naturalist in North Celebes" (March 20, p. 458), believes that the brush-turkey or moleo, *Megacephalon maleo*, has never been recorded as occurring in the smaller islands north of Celebes. I beg to remark that in the year 1879 I recorded this species from Siao, and in the year 1884 from Great Sangi, on both of which islands, besides, occurs a *Megapodius* peculiar to them, viz. *M. sanghirensis*, Schlegel, representing there *M. gilberti*, Gray, from Celebes (see the *Ibis*, 1879, p. 139; *Ibis*, 1884, pp. 6 and 53, &c.). Perhaps Mr. Guillemard did not comprise Siao and Great Sangi under the head of "smaller islands," but Dr. Hickson himself (p. 95) records two brush-turkeys from the smaller island of Tagulandang, a larger and a smaller one, and these must be *Megacephalon maleo* and a *Megapodius*. Tagulandang is situated between Celebes and Siao, and much nearer to the latter island. From the volcano islet of Ruang, opposite and within about a mile from Tagulandang, he only records (p. 41) one brush-turkey, and this, of course, may be either the *Megacephalon* or a *Megapodius*, if both do not occur, as appears rather probable. When I visited Ruang in 1871 after the heavy eruption in March of that year (see NATURE, vol. iv. p. 286), nearly the whole of its forest was destroyed and burnt down, and I do not believe that a living brush-turkey then remained on the islet; but it has since been re-peopled from its near neighbour, Tagulandang, where both species occur, and therefore, if the one could reach Ruang, the other may have reached it too. This is of no consequence at all. Dr. Hickson's following remark as to brush-turkeys on Tagulandang (p. 95), "The larger bird is perhaps the *Megapodius sanghirensis* of Schlegel, a brush turkey, which is bigger than the *Megacephalon*, and extends over the Sangir Islands," contains a mistake, as *M. sanghirensis* is much smaller than

Megacephalon nileo. The reviewer corrects, by the way, my calling the Celebean whimbrel *Numenius phaeopus*, saying that it is probably *N. uropygialis*, but these two names are synonymical, cf. for instance, Salvadori, *Orn. Pap.*, iii., 332, 1882, sub *N. variegatus*. As to its nesting on small trees "small brushes" were intended to be implied (see Legge, "Birds of Ceylon," 1880, p. 913).

A. B. MEYER.

Royal Zoological Museum, Dresden, March 22.

Crystals of Lime.

It was pointed out to me by Mr. W. J. Pope, of the City and Guilds of London Institute, that a lime cylinder which had been used in the lantern during a lecture had become distinctly crystalline where affected by the oxyhydrogen flame.

Examined under the microscope by polarized light, the crystals are seen to be well-defined cubes with striated faces. When immersed in water they break up and give rise to minute doubly refracting plates of rhombic outline, behaving in this respect like ordinary lime; the cubic crystals, however, are less rapidly affected by exposure either to air or water than is amorphous lime.

Lime is commonly stated to be infusible at the temperature of the oxyhydrogen blow-pipe; and the only crystals previously recorded, so far as I know, are those obtained by Brügelmann, by fusing calcium nitrate (*Annalen der Physik und Chemie*, ii. p. 466, iv. p. 277, 1877-78). It seems, therefore, worthy of notice that they are possibly always formed upon the surface of the lime cylinders by the action of the oxyhydrogen flame.

The crystals resemble in all respects those described by Brügelmann. The jet used on the present occasion was an ordinary blow-through jet.

H. A. MIERS.

Foreign Substances attached to Crabs.

I AM glad to see that Mr. Garstang agrees with me in regarding the presence of the Ascidians on *Hyas* as accidental.

I had no intention of decrying the value of Mr. Garstang's experiments with Ascidians, but his rule might, perhaps, be limited to those members of the group to which it can be proved to apply. Under natural conditions it apparently fails to apply to *P. corrugata* and *M. arenosa*. As to the latter, Prof. McIntosh assures me that he has frequently found it in the stomach of the cod and haddock.

The appreciation of the cod for *A. mesembryanthemum* is, I think, sufficiently proved by the fact that the latter is one of the most successful cod-baits used here.

ERNEST W. L. HOLT.

St. Andrews Marine Laboratory, March 29.

Wimshurst Machine and Hertz's Vibrator.

It may interest those who wish to repeat Hertz's experiments on electro-magnetic radiation to know that many of these can be done very well by using a small Wimshurst machine in place of the usual induction coil and battery. The vibrator and resonator which we used were like those described in *NATURE* (vol. xxxix. p. 548), and the Wimshurst machine had two 12-inch plates (giving at most with the jars on a 4-inch spark). The wires from the vibrator, instead of being connected with an induction coil, were connected with the two outer coatings of the jars of the machine. The machine spark-gap and the vibrator spark-gap should be so adjusted that when a spark occurs at the former one also occurs at the latter. With the apparatus described we got good results when the spark-gaps were 38 mm. and 3 mm. respectively. The outer coatings of the jars are only connected together by the wood of the machine, but it is sometimes an advantage to put a few inches of damp string between the balls of the vibrator.

This combination is obviously a modification, adapted to work a Hertz vibrator, of one of Dr. Lodge's well-known Leyden jar arrangements.

No doubt many persons have connected the vibrator directly with the terminals of the machine, but this arrangement does not work nearly so well.

T. A. GARRETT.

W. LUCAS.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meeting of the Institution of Naval Architects was held under the presidency of Lord Ravensworth, on Wednesday, Thursday, and Friday of

last week. There was a fair list of papers on the programme, although at one time, shortly before the meeting, it was feared that there would be a sad lack of contributions from members. At the last minute, however, one or two papers came in, and the list, although perhaps below the average in the importance of the memoirs, was of passable interest.

The following is a consecutive enumeration of the business that was transacted at the meeting:—

Wednesday, March 26th: morning sitting—Annual Report of the Council, and other routine business; Address by the President. Paper read and discussed—Notes on the recent naval manœuvres, by Mr. W. H. White, F.R.S., Director of Naval Construction.

Thursday, March 27th: morning sitting—The Maritime Conference, by Rear-Admiral P. H. Colomb; strength of ships, with special reference to distribution of shearing stress over transverse section, by Prof. P. Jenkins; steatite as a pigment for anti-corrosive paints, by Mr. F. C. Goodall. Evening sitting—On the evaporative efficiency of boilers, by Mr. C. E. Stromeyer; on the application of a system of combined steam and hydraulic machinery to the loading, discharging, and steering of steam-ships, by Mr. A. B. Brown; the revolving engine applied on ship-board, by Mr. Arthur Rigg.

Friday, March 28th: morning sitting—On leak stopping in steel ships, by Captain C. C. Penrose Fitzgerald, R.N.; on the variation of stresses on vessels at sea due to wave motion, by Mr. T. C. Read; spontaneous combustion in coal ships, by Prof. Vivian Lewes. Evening sitting—Experiments with life-boat models, by Mr. J. Corbett; on the screw propeller, by Mr. James Howden.

The annual dinner was held on the evening of Wednesday.

Out of the above list of a dozen papers there were fewer than usual of scientific interest, and, indeed, in one or two instances they were not either distinguished by practical interest. Mr. White's paper, which formed the *pièce de résistance* of the meeting, was of military rather than scientific importance, and was chiefly notable from the number of admirals that took part in the discussion; indeed, the whole naval contingent of the Board of Admiralty was present to hear the paper read. Admiral Colomb's paper on the recent Washington Maritime Conference was practically reduced to a consideration of the rule of the road at sea. The general opinion of the authorities assembled appeared to be that the present rule of the road is very well as it stands, with the exception that the "holding-on ship" should not be required, or even allowed, to slacken her speed. This seems in conformity with common sense. If two ships are converging towards a point, say at right angles to each other, and one shifts her helm to go under the other's stern, if the second, or holding-on ship, slacken speed, the probability will be that the giving-way ship will crash into the other's broadside or cross her bows; in the latter case, there is probability that the holding-on ship will give the other her stem. What is most wanted when danger of collision arises, is certainty on each vessel as to what the other may be going to do. If the holding-on ship never slacken speed—is not allowed to slacken speed—then the other vessel knows exactly what course to take; as the law stands, the quartermaster, or officer in charge, is never quite sure until the last minute, especially at night, whether the other ship considers there is danger of collision or not, and, therefore, whether she will slacken or keep to full speed. We anticipate the proposed alteration, if put in force, will greatly lessen the list of collisions.

The memoir contributed by Prof. Jenkins on the strength of ships was decidedly the most important contribution to naval science of this year's meeting. The paper will open up to the majority of those practi-