Tidal Phenomenon in Lake Constance

FOR the second time within 185 years the great sheet of water called the Lake of Constance, the Boden See, or the Suabian Sea, whose superficial area exceeds two hundred square miles, has been frozen over.

In connection with it a very interesting phenomenon has been noticed. At a time when the air was perfectly still and during intense frost the ice broke away in the middle of the lake and came crashing upon that nearer the shore, under which it forced itself or piled itself up in great heaps. An experienced skipper on the lake says there is no doubt that as nearly as possible every twelve hours the great fields of ice move backwards and forwards upon the lake. He adds that both in summer and winter he and his comrades have noticed during an absolute calm a powerful movement in the water, backwards and forwards, sometimes so strong as to require double force to propel the ship. Can any of your readers tell me if this is a true tidal movement?

Another fact which came under my notice to-day may interest your readers. In many places on the frozen surface of the lake and especially near the shore, there are great white spots varying from a foot to two or three yards in diameter. At these spots marsh gas has accumulated under the ice, and upon piercing them and applying a light, a flame will mount up I am told sometimes as high as six feet, though in those in which I experimented to-day it did not rise more than two feet.

SAMUEL JAMES CAPPER

Hotel Helvetia, Kreuzlingen, Switzerland, February 17

Meteors in New Caledonia

DURING the last few nights we have seen numerous flights of small meteors; indeed, so frequent have they been, that they have attracted the notice of the most casual observers. I first observed them on the night of the 9th inst. No fixed direction seems to be followed; in fact, I saw one display such as I have never seen before, which will illustrate my meaning. Two fair-sized meteors proceeded severally from the neighbourhood of Castor and Pollux, and crossed mid-way between those two stars. To me it was a very interesting sight.

A neighbour (a lady) informed me she saw a very fine meteor on the 10th, which left a long trail of light, and burst into shining fragments very like, as she expressed it, "the head of a rocket." The direction pointed out was rather low down in the north-north-west. We have had an unusually long, cool season, which has been quite delightful. Now, for some days past, the heat has set in; the air is charged with electricity; heavy thunder-clouds cling round the mountains in the interior, and frequent lightning-flashes are seen, but no thunder heard. On Saturday, the 13th, heavy rain came up against the wind and drowned out a pretty children's *fête*, the distribution of prizes at the Government Schools; serious colds are prevalent in consequence, your humble servant and his family being in the full tide of fashion, a distinction we could very happily have done without. E. L. LAYARD

British Consulate, Noumea, December 13, 1879

Intellect in Brutes

MR. THOMSON'S communication in NATURE, vol. xxi. p. 324, has reminded me of an incident which may be of interest to your readers. I have a well-bred and gentle tortoiseshell cat, a feline lady. It is her habit not to steal food from dishes which the family is using; in cold weather, if a dish is placed in the fender to keep warm, its contents are safe from pussy. She has a kitten by no means so refined as herself, one, in fact, that takes after the other parent, a half-wild cat of the gardens. One morning recently the old cat was lying at our breakfast time upon the hearthrug; the kitten was playing about. It was a very cold morning, and a plate of herrings was put into the fender to be kept warm until they were to be eaten. The kitten smelling the fish, stepped gaily forward, with tail erecting itself, towards the fender. An angry growl from the old cat attracted the notice of all in the room, and to my intense amusement and surprise, I saw her strike the kitten a violent blow in the chest, strong enough to overturn the little creature, which retired humiliated to another part of the room. ALEX. MACKENNAL

Bowden, February 14

A FRIEND in a village in the south of Scotland has a she cat, a great pet in the household. One night, when the lamp was being trimmed, some paraffin was spilled on puss's back, and a short time after, going near the fire, a falling cinder set her in a blaze. In an instant she made for the door (which happened to be open) and sped up the street about 100 yards, and with a tremendous leap plunged headlong into the village watering trough, then stepped out, gave herself a shake, and trotted quietly home. The trough had eight or nine inches of water, and puss was in the habit of seeing the fire put out with water every night. W. BROWN

Greenock

THE ARTISAN REPORTS ON THE PARIS EXHIBITION OF 1878[1]

THE Society of Arts deserves the thanks of all who are interested in the progress and elevation of our national industries for the manner in which it has attempted to bring home to British manufacturers and artisans the lessons of the Paris Exhibition of 1878. As in 1867, so in 1878, it took a prominent part in the movement for sending over to Paris a number of selected artisans, whose reports on the exhibits of the various departments of industry they represented the Society has now published. Thanks to the interest shown in this step by H.R.H. the Prince of Wales, and by Sir Philip Owen, the artisans sent over by this agency, some two hundred in number, were enabled to visit also a number of the workshops and factories of the French capital, to judge for themselves of the conditions under which the various industries are carried on. The thirty-nine selected Reports printed in the volume before us, form therefore, an extremely interesting and valuable contribution to our knowledge of the relative conditions of the skilled industries in the two countries. The frequent comparisons drawn from the workman's point of view not only upon the quality of workmanship but also upon the conditions and price of labour, the machinery, the tools, and the character of the workmen, are striking and instructive in the extreme.

The Reports range over a wide area of subjects. Porcelain, Earthenware and Glass, head the list with seven separate Reports. Next come Ornamental Iron-work, Wood-carving and Stone-carving. After these are Reports on Machine-Tools, Mechanical Engineering, Agricultural and Horticultural Implements, Bricklaying, Stone-work, Plaster-work, Joinery, Cabinet Making, Clock and Watchmaking, and Jewellery. Optical Instruments have a Report to themselves, followed by others on Machinery for Printing, Spinning and Weaving, on Saddlery and Harness, Shoemaking, and Caoutchouc, whilst the volume closes with a Report on Mining Appliances, and one on Iron and Steel Manufacture.

The topics incidentally touched upon by the artisan reporters are not less wide in their range; they extend from an account of the style of dancing in vogue at the Sunday evening balls in the cafés of Belleville, to a description of a harmony in gold and yellow by Mr. Whistler, which we are told "looks as though the ground had been prepared with a sticky substance, and a shower of gold leaf had been thrown from above." It would be impossible in the space of any mere Review to comment upon all the points of scientific interest raised in these multifarious Reports. To obtain from a perusal of them anything like a connected or accurate view of the relation of science to skilled labour in the systems in vogue in French workshops is almost equally hopeless, since the very different styles of writing and modes of observation of the various writers preclude strict comparisons between one department of industry and another. Nevertheless there are a number of salient features which seem to call for notice.

The Report on Optical Instruments by Mr. M. Lambert,

[1] Published for the Society of Arts, by Sampson Low and Co., London 1879.

of Dublin, speaks of the Telescopes shown by Grubb, Horne and Thornthwaite, and Dallmeyer, as unapproached by any shown by Continental opticians. Mr. Lambert regards the French instruments as a whole, as too lightly constructed to give precision or durability; and though English work errs in the opposite direction, he thinks that a judicious compromise would not only add to elegance of appearance, but would reduce the cost. He adds his opinion that much of the optical work imported into this country might be done as cheaply or more cheaply at home if employers would give the same facilities for working which French operatives have. The French avail themselves largely, it appears, of tools which are not much used for this class of work in England, small planing machines, shaping machines, and rotating cutters. The very fine quality of the brass used in the French Instruments attracted the attention of the reporter.

From Mr. Walker's Report on Machine Tools we learn that Continental engineers are still copyists, though perhaps in some ways in advance of us in the extent to which such appliances are used throughout the industries. The American Section, however, told a very different tale; for here the amount of novelty was almost inconceivable, and the designs had all the freshness of being struck from first principles. The automatic grinding machines of Messrs. Thomson, Sterne, & Co., and the hydraulic plant for boiler building of Messrs. Tweddle called for special comment amongst English exhibits. Mr. Walker points out that we have given too little attention to the necessity which is implied in the employment of machine tools, for skilled workers of a high order; and he thinks that this skill is of a kind which an English workman is better fitted to acquire than a French workman; for the latter has semi-artistic tastes that are not satisfied by machine work. "Let the Frenchman be set to carve a crockett, or to cut a glove, or to shape a meerschaum pipe, or to do any task on which he can claim the result as his own, his soul lightens up." "His own work must be made to appear conspicuously in the result, or his interest in it is gone. This personality in work is not easily attained in the manufacture of heavy machinery."

The first of the Reports on Mechanical Engineering by Mr. J. W. Phillips, speaks of the number of machine-tool makers represented in the French gallery, and of the excellence of their work. Amongst the American machines bearing the stamp of original thought commented upon in this Report, is a screw-making machine of very extraordinary precision and merit. There are a few discrepancies between the three reporters upon Mechanical Engineering, discrepancies which doubtless arise from their visits having been brief and independent. One who expected to find the French artisans deficient in energy, says that "a more earnest and thoroughgoing set of men" he never encountered in a workshop; while another says that "the energy put into their work by the mechanics was certainly much below what we are accustomed to see in England." One mentions tools of novel and superior construction; another sees "very very few tools" that he would think worth introducing into England; while the third says that in machines and tools there is so great a similarity that their nationality would be unrecognisable if it were not for the makers' names on them! One praises the get up of the iron and steel work from the Creuzot works; and while another sees nothing in it worthy of mention, the third speaks of it as a very magnificent contribution, of which any English house might have been proud. All of them comment on the Technical schools, which afford to French engineers in such abundant measure, opportunity to pursue scientific and theoretical courses of instruction. The Report of Mr. Hopps devotes no fewer than five pages to a description of the Municipal School for Apprentices in the Boulevard Villette, the pupils of which institution contributed a very admirable display of specimens of forging, turning, fitting, and carpentry, as well as several larger machine-tools made in the workshops of the school.

The two Reports on Watch and Clock-making, by Mr. Ganney and Mr. Warwick, contain a host of matters of scientific interest, and are well worthy of study. We learn also that, apart from the introduction of labour-saving machinery, the means of production of watches and the forms of the watches themselves are what they were at the beginning of the century; that the Swiss toolmakers annihilated the English watch toolmakers some years ago, and that no English watchmaker has made repeating movements for the last fifty years, the repeating train being imported and fitted to an English going train. Mr. Warwick mentions an American compensating balance in which V-shaped notches filed in a steel rim are filled in with a more expansible brass composition; a device which is probably in every way inferior to the numerous bi-metallic rim-balances with continuous laminæ that have from time to time been devised. He also speaks of certain American watch manufacturers who claim to possess the art of *conferring on springs the property of isochronism* by machines; and adds that as no idea of the machine employed for the purpose was given, "it must be left to individual credulity to form what notion it pleases of this invention." Mr. Warwick mentions with praise the exhibits of the French and Swiss Schools of Horology. Some of these, he says, contained a number of most interesting models of every form of escapement, all mounted with the escapement on the top, so as to facilitate examination; most of them were wound up and going, so that the action could be seen. They were all constructed on a large scale, the balances being four inches in diameter, so that the parts could be well observed and studied. There were working models of escapements on blackboards, with movable parts to show the action and the working angles, which were traced out on the board. "Standing before these objects," he adds, "one could not, as an Englishman, but envy them, and carry his thoughts back to his own land with regret that there are no corresponding institutions for technical education there." Mr. Ganney was even more struck by the advantages possessed by France and Switzerland over our manufacturers in possessing institutions for training workmen of the very highest skill in the theory and practice of their craft. He enters into details about the Horological School of Besançon, its system of instruction, and the extraordinary successes it has achieved. He gives a list of the work turned out by their head pupil, who after being in the school thirty-four months had completed with his own hands nearly fifty watch movements, including a fusee keyless pocket chronometer, and a keyless repeater lever finished and fully jewelled by the pupil. He adds, that as many *years* might have been deemed a reasonable time for learning so much, and that it is doubtful whether the whole English trade contains any English trained workman of experience who could do such a variety of work so well. Self-sufficiency appears to be the characteristic of the English watch trade: with the result that while we turn out less than 150,000 watches a year, America turns out nearly half a million, Switzerland and France some six millions; the French industry having risen in the last thirty years from 40,000 to over a million watches per annum. It appears that good work is as dear in America as here, though a little cheaper in France or Switzerland; but, on the other hand, the Swiss can sell a complete watch in a case, or the Americans a complete watch without a case, for very little more than is charged for an unfinished English blank movement alone; and this solely on account of the labour-saving appliances which they employ.

The other Reports, particularly those on Caoutchouc, on Ornamental Ironwork, and on the Porcelain and Glass

Manufactures, are well worthy of attention, but as they deal with the artistic rather than with the scientific aspect of those industries, we cannot dwell upon them.

Amongst the instructions handed to each artisan reporter at the outset, were suggestions to ascertain the prices and cost of production, the relative amount of machinery employed in production, the hours of labour and the manner of living of the French artisans. Much useful information has been collected on most of these heads. Almost all the reports agree that while cost of living is perhaps a little cheaper in Paris than in London, wages are on the whole much lower; so that it is only by working longer hours and by thrift and steadiness that the French workman can live. The remark is almost universally made that drunkenness is extremely rare; while the absence of almost everything that constitutes home life is equally conspicuous in the habits of the Parisian workman.

In one or two points the volume before us is, from the nature of things, strangely defective. Almost all the reporters who mention the subject at all, appear to have misapprehended the nature and status of the *Cercles ouvrières* or *Corporations ouvrières*, which are the nearest approach in France to the Trades Unions of this country, and the comparisons drawn between the two are in consequence often irrelevant or incorrect. These bodies in France cannot legally extend beyond the limits of the "commune" or parish; they are usually semi-political or socialistic in character, and while they concern themselves with the conditions of labour, are not exclusively occupied in matters of wages and hours of work, and do not, from the local restriction on their operations, exercise an influence in any measure comparable to that exercised by the English Unions over the price or conditions of labour. Again it is impossible to derive from the reports any ideas upon the relation between skilled labour and the educational systems in operation in Paris or in the provinces of France, for the simple reason that not one of the reporters appears to have been made acquainted with those educational systems as a whole. A few of the more prominent technical schools, the *École d'Apprentis*, the *Horological Schools*, and the *Typographic School* of MM. Chaix and Co., are indeed mentioned; but beyond these exceptional institutions and a chance reference to the free evening schools of drawing and modelling which are to be found in every quarter of Paris, there is no reference to the educational systems of the country or to their influence on the artisan, the foreman, and the employer. Any account of the conditions of the skilled industries in France which leaves these out of consideration must be regarded as imperfect in the extreme.

One result is however unmistakable. The artisans who drew up these reports were fully alive to all the advantages of which accrue to an industry from the extension of labour-saving appliances, and from the dissemination of higher technical knowledge. They have faithfully pointed out those departments of industry in which we excel, and those in which we are excelled. They have in most cases stated their opinions as to the causes which have brought about these results. It will be our own fault if we do not strengthen the weak points and fill the gaps now revealed to us. The strides made by some of our foreign competitors are so great as to leave us no margin for indolence or wastefulness on our part. The less favoured nation may more than make up for the material disadvantage of having to import raw products and fuel by the superior thrift and the better training of its workmen. All these things point to the need at home to lose no opportunity of pushing forward the scientific and artistic culture of the workers and of their employers, so that their training may at least be not inferior to that of their Continental rivals.

SILVANUS P. THOMPSON

HOW TO COLOUR A MAP WITH FOUR COLOURS

SINCE the publication in the *American Journal of Pure and Applied Mathematics*, vol. ii. part 3, of the solution of this problem obtained by me, and referred to in NATURE, vol. xx. p. 275, I have succeeded in obtaining the following simple solution in which mathematical formulæ are conspicuous by their absence. It may be premised that the problem is to show how the districts of a map may be coloured with four colours, so that no two districts which have a common boundary or boundaries shall be of the same colour. The object of this colouring being to make the division of the map into districts clear without reference to boundary lines, which may be confused with rivers, &c., it is obvious that nothing will be lost if districts which are remote from each other, or touch only at detached points, are coloured the same colour.

The only parts of the map that it is necessary to consider are the districts, boundaries, and points of concourse, *i.e.*, points at which boundaries terminate. Two districts may have a single common boundary, or they may have two or more such boundaries. Any two districts which have more than one common boundary, inclose one or more groups of districts; in any one of these groups two districts which have more than one common boundary inclose one or more groups of districts, and so on. Proceeding in this way, we limit the area under consideration more and more at each step, and must finally come either to a group which has no pair of districts which have more than one common boundary, or to a single district having only two boundaries, one in common with each of its two surrounding neighbours. *Thus every map must have at least one pair of adjacent districts which have only one common boundary* (β).

Every boundary is either continuous like a circle, or has two ends which lie at the same or at different points of concourse. Every point of concourse may be called *triple*, *quadruple*, &c., according to the number of *lines* radiating from it. I expressly say *lines* and not *boundaries*, because if two ends of any boundary lie at the same point of concourse two of the lines radiating from the latter will belong to only one boundary. If a boundary whose ends lie at two different points of concourse be rubbed out, the number of lines radiating from each of those points of concourse will be reduced by one, thus if the two points were each triple points, they will become double points, *i.e.*, they will no longer be points of concourse, the two remaining lines which radiate from each becoming one boundary. The result is that rubbing out a single boundary *may* reduce the number (B) of boundaries in the map by three. It can, however, never cause a greater reduction, and may cause a smaller, *e.g.*, rubbing out a continuous boundary, or one which ends in two quadruple points reduces the number of boundaries by one only.

Now the obliteration of the boundary β causes the two districts it separates to become one, thus reducing the number of districts (D) in the map by one, and the map still remains a map, and has therefore a pair of districts having only one common boundary. Obliterate this common boundary, and so on. We finally get a blank sheet, *i.e.* a single district and no boundary, and each reduction of D by one cannot involve a reduction of B by more than three; thus 3D must be greater than B, consequently 6D must be greater than 2B; but 2B is the number which would be arrived at if we counted both sides of every boundary, *i.e.*, the number which would be arrived at if we counted the number of boundaries to each district and added them all together; thus the number arrived at by the latter computation must be less than 6D, *i.e.*, it is impossible that every district can have as many as six boundaries, *i.e.*, *every map contains at least one district with less than six boundaries.*