by south, the Eastern Bay affords good shelter to vessels of all classes in from 4 to 12 fathoms, and upon pretty good holding ground."

The last edition of the "Admiralty Channel Pilot" says :—

"Off the pitch of the Ness, near the lighthouse, it is steep-to, there being 4 fathoms at 100 yards, and 15 fathoms at 330 yards from the beach. . . . The roads on either side of Dungeness afford excellent and extensive anchorage, according to the state of the wind, with good holding ground, consisting of fine sand over clay and mud."

The Chesil bank, to the West of Portland, in a deep embayment, away from the current of tide, is a remarkable example of the heaping-up power of the wind-waves from the south-west, as it is piled up at the leeward or eastern end, next Portland, 30 feet above high water, or treble the normal height above the sea of such formations.

The Harbour Commission of 1840 reported against Dungeness as a site for a refuge harbour of artificial formation, on account of the continued increase of the spit, as indicated by the necessity for altering the position of the lighthouse, which at its re-erection in 1792 was 100 yards from the sea, and at the period of a then recent survey was 218 yards distant, showing an increase of 118 yards in 47 years. The original lighthouse was, at the erection of its successor in 1792, 640 yards from the shore. The Harbours of Refuge Commission of 1844 also reported on it, referring to its excellent anchorage, and the danger of interfering with nature in such a spot. The changes in this remarkable formation have been so extraordinary, as fully to endorse these official conclusions, and the various vicissitudes it has undergone demand more careful consideration than is usually afforded by those who advocate artificial works, the effect of which on these nicely-balanced movements would possibly be as problematical as the turning of these shingle "fulls" into quarries for building purposes would be suicidal, and either course might result in a baneful interference with one of the finest natural breakwaters on our coasts.

J. B. REDMAN

Dispersal of Bivalves

REFERRING to the fact mentioned in Mr. Darwin's letter, that mussels are sometimes brought up on the point of a hook, it is common, in shell collections, to find "Heart Cockles" (*Isocardia cor*), which look exactly as if they had been drilled each with a small hole, centred at some point in the opposed edges of the two valves.

These specimens have been taken by the long-line fishermen on the Irish coast, and the apparent puncture is caused by the animal having closed upon the shank of an accidentally intrusive fish-hook with such force as to crush the edges of the shell against the steel wire.

Numbers of this comparatively rare species have been thus procured, for Isocardia will allow itself to be drawn in with the line rather than open its doors to new possibilities of danger while the hook is within.

D. PIDGEON

Holmwood, Putney Hill, April 12

The Yellow River and the Pei-ho

As bearing on the subject of my paper on the hydrology of the Chinese rivers, which was published in NATURE (vol. xxii. p. 486), I take it upon myself to forward the substance of some observations made by Mr. T. W. Kingsmill—president of the North-China branch of the Royal Asiatic Society—at a meeting of the Society in September, 1880.

Having made measurements of the cross-section of the Yellow River, and having obtained the most reliable information he could gather regarding the depth of water and the speed of the current at different seasons, Mr. Kingsmill roughly estimates the discharge as follows :—

Extreme low water	18,000	cubic feet per second.
Ordinary ,, ...	36,000	,, ,,
Flood discharge	112,000	,, ,,

The average discharge he is inclined to estimate at about three-fourths of the single estimation supplied in Sir George Staunton's narrative; and he places it at, or rather surmises that future careful observations will estimate it to be, 300,000,000 cubic feet per hour, or about 83,000 cubic feet per second.

With reference to the Pei ho, Mr. Kingsmill, from an observation made in the summer of 1879, estimated its water-discharge at 9000 cubic feet per second. My own estimate was confined to the winter months; but for reasons given in my paper I considered it fairly typical of the whole year, viz. 7700 cubic feet per second. That I was justified in so doing, this independent observation of Mr. Kingsmill sufficiently proves.

H.M.S. *Lark*, Auckland, February 28 H. B. GUPPY

Table of the Appearance of Rare Lepidoptera in this Country in Connection with the Sun-Spots

THE following table is a numerical abstract of the records relating to the capture of certain rare lepidopterous species in the United Kingdom, condensed from a larger table presenting an abstract of the pages of the *Magazine of Natural History*, *Zoologist*, *Entomological Magazine*, *Entomologist*, *The Entomologist's Weekly Intelligencer*, *Naturalist*, *The Entomologist's Annual*, *The Yorkshire Naturalist*, *Newman's British Butterflies*, and other works. It will show the relation existing between the sun-spot cycles and the appearance of the species, yet not quite so distinctly as my larger compilation, since, in order to adapt it to the pages of NATURE, it has been necessary to equalise the sun-spot cycles, which has caused, I fear, a certain overlapping of the cycles of capture, which really are well defined. I was not aware until quite recently that any one had been before me in this branch of entomology, but I now find my remarks in the *Journal of Science* for August, 1881, corroborated in a previous publication (Dr. F. G. Hahn, "Ueber die Beziehungen der Sonnenfleckenperiode zu meteorologischen Erscheinungen," pp. 155-157, Leipzig, 1877). This pamphlet is noticed (E. D. Archibald, NATURE, vol. xix. p. 145, article, "Locusts and Sun-Spots").

Years.	Sphinx Convolvuli.	Delephila Galii.	Deilephila Livornica.	Chærocampa Celerio.	Chærocampa Nerii.	Colias Edusa.	Colias Hyale.	Argynnis Lathonia.	Vanessa Antiopa.	Pieris Daplidice.		
1832, 43, 54, 65	1	1	4	25	2	309	62	16	13	—	433	
1833. 44 55, 66	1	2	1	1	2	382	71	3	1	—	464	*m*
1834. 45, 56, 67	23	14	11	16	6	117	18	10	5	1	221	
1835, 46, 57, 68	735	14	40	14	4	440	1109	136	79	12	2583	+
1836, 47, 58, 69	121	7	5	1	1	116	6	48	14	6	325	
1837, 48, 59, 70	162	233	30	3	2	95	13	10	3	9	560	
1838, 49, 60, 71	20	3	20	11	1	345	7	3	1	8	419	M
1839, 50, 61, 72	5	—	2	5	—	80	47	308	7	3	457	
1840, 51, 62, 73	9	3	8	—	2	5	5	20	—	—	52	
1841, 52, 63, 74	—	—	—	2	--	9	—	27	5	4	48	–
1842, 53, 64, 75	162	—	1	11	1	67	213	9	—	1	465	

The numbers give the amount of captures in the years specified; but in the case of *C. Edusa* and *C. Hyale* a 10 has been placed for every notice of "abundant," a 5 for every notice of common, the number of captures not being often stated.

Abbreviations employed + maximum appearance, – minimum of appearance, *m* minimum of sun-spots Wolf, M maximum of sun-spots Wolf.

A. H. SWINTON

Binfield House, Guildford, March 23

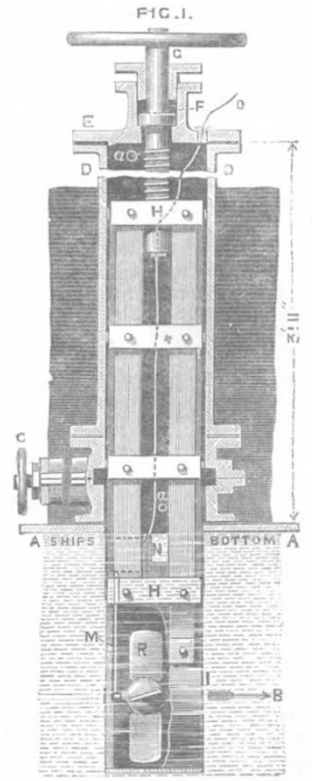
THE APPLICATION OF ELECTRICITY TO SHIPS' LOGS

THESE are days of rapid scientific progress, and the great interest so recently excited by the application of electricity, in a new and startling way, to transmit information, has been almost eclipsed by the attention which its use for lighting and the transmission of power has attracted. Though no longer confined to signalling, yet this is still its most important use, and one for which its employment is being extended in many directions, always with the most satisfactory results. It is with the application of electricity this fleet messenger for giving a constant record of the rate of a ship, that this article is concerned. Before, however, dealing with this matter, it will be well to say a few words about logs generally.

Ordinary ships' logs are of two kinds, called respectively harpoon and taffrail logs. Harpoon logs, which are the more extensively used, consist of a cylinder, on one end of which works a fan or screw, registering the number of revolutions by means of clockwork within the cylinder, the dial being visible through a glass face. To the other

end, which is conical, a rope is fastened, so as to enable the log to be towed by the ship. A modification of this is called the "detached" log, the revolving fan and case for the clockwork being two separate pieces. To both these logs there are several objections, such as the almost unavoidable entrance of salt water to the wheelwork, the drag on the ship, which is often as much as 40 lbs. or more, the inconvenience of hauling in the log each time it has to be read, and lastly, the loss of the whole instrument, should the towing-line break.

To obviate these objections, the taffrail log was invented, and which goes a step further than the detached log, by taking away the recording portion to the taffrail of the ship, and causing the towing rope to transmit the revolutions of the fan to it. These logs are, in many respects, a great improvement on the first; the registering dial is less liable to damage, and is always visible; the tension of the towing line is less; it is therefore less liable to rupture, and even when this does take place, the fan is



easily replaced. On the other hand, the unsuitable nature of the towing line for transmitting torsional force, is obvious. Further, the slip of the fan must by seriously affected by the constant variation, in length, of the submerged portion of the line. In Walker's log these difficulties are partly met by the use of a governor, consisting of a pair of weights fixed to the towing line, and revolving with it; but this device can only modify the evil.

The late Mr. W. Froude, who pointed out other objections to existing logs, endeavoured for some time to devise an electrical log, in which the revolutions of an accurately formed screw should be communicated to the deck, *not* by the revolution of the towing rope, but by an electric current in wires carried by it. Eventually he succeeded, in conjunction with Mr. Brunel, in constructing an instrument of this kind, which was applied to Sir W. Thomson's yacht, *Lalla Rookh*, and worked very well, till by some mischance, it carried away and was lost. Mr. Kelway had, meanwhile, been working independently with the same end in view, and had constructed an electric log, which he brought before the notice of the Admiralty. A trial of this last instrument was undertaken by Messrs. Froude and Brunel, on board H.M.S. *Shah*. In this trial, the registering portion was placed on the poop, and self-recording apparatus was used, by which at every revolution of the fan a pen was lifted from a strip of paper moved by clockwork, thus causing breaks in the otherwise continuous line. On a line parallel to this, time in half seconds was simultaneously recorded. The result of this trial was to clearly demonstrate the satisfactory action of Mr. Kelway's log, and it was afterwards applied, together with accurately formed fans, to H.M.S. *Iris*, and the yacht *Alberta*. Its further extension has not been proceeded with, apparently in consequence of Mr. Froude's decease. Quite recently the same inventor has put into practice the happy idea of placing the electrical log to work altogether under the ship's bottom. The way in which this is done is shown (Fig. 1). A water-tight case is securely fixed to the bottom plates (AA), in this case a frame (HH) is moved up and down, and in the lower part of the frame the fan (R) works. The fan communicates its motion by a vertical spindle (M) to a box (N), in which electric contact is made and broken eight times in a mile. The wire (OO) can thus transmit a record of the distance passed over to a dial or dials fixed in any part of the ship.

This invention has the advantage of allowing the screw of the instrument to work in water of uniform pressure, and to a great extent free from the disturbing action of the waves. There is undoubtedly a body of water carried along by the surface friction of the ship. The depth to which this extends is unknown, but there is strong reason to think it is very small, and would not therefore affect the fan. The log itself, however, offers an excellent opportunity of investigating this obscure point, since it can easily be raised or lowered to different positions.

The complete instrument is at present being exhibited at the Crystal Palace Electrical Exhibition, and an account of its various applications has been recently given in a paper by Mr. Kelway. These applications are many and important, and the invention, besides being very suitable for its original purpose, promises to afford valuable information, not to be obtained by the use of ordinary logs. H. S. H. S.

THE TONNAGE QUESTION

ONE of the most interesting papers discussed at the recent meeting of the Institution of Naval Architects was on the Revision of the Tonnage Laws. The author, Mr. W. H. White, is, from his position as Chief Constructor at the Admiralty, as well as from his well-known attainments, a singularly impartial and able judge of this most difficult question. The occasion which called forth the paper was the report on the tonnage question lately issued by the Royal Commission, which last year took evidence on this subject. The report was, as is well known, not signed by all the commissioners. Two of them, viz. Mr. B. Waymouth, Secretary to Lloyd's Register, and Mr. Rothery, Q.C., the Wreck Commissioner, wrote independent reports, which differed widely from that of the majority, and from each other.

The state of the Tonnage Laws has for a long time past given rise to serious complaints, on various grounds. As matters stand at present it is possible for a steamer not only to have no tonnage at all, but even, as is the case of a vessel well known on the Clyde to have a negative tonnage. It is also alleged that the indiscriminate measurement of all inclosed spaces on deck for tonnage has a direct tendency to produce unsafe vessels, by taxing the covering in of the large open spaces above the engine, &c., and also by unduly taxing vessels provided with hurricane decks, which, from their nature, can never be entirely filled with cargo.