The vertebral blocks, as well as the ribs, are the product of the primitive axial series of (invertebral) discs, which, when completely arrayed, each bear five branches, viz., two pair of hæmal arches, two pair of neural arches, and a fascicle of parallel cleets, so to speak, which being cemented together, both in the front and rear, by the superficial ossification of the discs at either end, are fused into the block pieces, as found, *e.g.* in the young hog; the cementing slab covering the big neural rib head likewise, and not only the pentagonal prismatic block. The first disciform ossification we find in the corals, forming cribrose ethmoidal discs, such as the closely set "sigillate impressions" of the Astræa, and afterwards left behind as the coccyx, *e.g.*, of Byathophyllum.

SIEMENS' DYNAMO-ELECTRIC LIGHT*

A SERIES of experiments was made last week at Sheerness, with a view of ascertaining the applicability of Siemens' dynamo-electric light to torpedo services in time of war. This scientific combination is produced, as its name signifies, by the application of excessively rapid motion generated from the fly-wheel of a steam-engine to a very powerful set of ordinary galvanic "coils" in connection with soft-iron magnets. The leather strap from a four-horse power engine, encircling a small gun-metal pinion, causes it to revolve with the extreme velocity of 1,600 revolutions per minute, inducing motion in an electric "bobbin" at the side of an apparatus consisting of several sets of strong insulated coils. A stream of electricity consequently passes through them. This stream is conducted to a second series of coils, larger and more powerful than the first, which are also in combination with a pinion revolving 800 times per minute, thus intensifying the stream as it passes through them to a very considerable degree. Both negative and positive currents are now alternately given off from another "bobbin" at the side of the second series of magnetic coils, to the train of insulated wires, which conveys them to the position from which the dynamo-electric light is to be exhibited. Here there is a delicately contrived apparatus for containing the carbon points, between which the light is to be generated, adjusted at the top of a tripod somewhat similar in construction to that of a surveying instrument. At the back of the two carbon points, and "slotted" vertically to admit of their holders passing through it, is a concave reflector of white polished metal, which collects the rays of light into a focus, and transmits them in any required direction by means of an adjusting hand wheel below. A minute aperture in the centre of the reflector, precisely behind the junction of the two carbon points, throws a representation of the flame upon a piece of opal glass in a frame fixed at the back of the reflector; and through the agency of another small hand wheel which causes the carbon points to approach or recede from each other, the flame can be reduced or intensified at pleasure, by simply turning the wheel, care being taken at the same time to keep a watchful eye upon the picture produced, as the withdrawing of the points to too great a distance from each other will extinguish the light. It should have been remarked before that ample means are taken by lubricating the electrical apparatus to counteract the evil effects which might otherwise arise from the excessive friction consequent on the rapidity of motion in the several parts.

The object of instituting the series of experiments which were made on Monday was to ascertain if it was possible to throw such a stream of light upon an enemy's working parties engaged in interrupting communications with a line of torpedoes at night, as would render them sufficiently conspicuous to be fired at and consequently driven off. The place selected was the new fort at Garrison Point, Sheerness. The engine and "coils" were erected in the enclosure of the fort, while the instrument itself was placed in one of the massive embrasures piercing its sides. No sooner was steam got up and the order given to turn ahead, than the burring noise of the machine indicated that electricity was being rapidly generated, sparks and stars of vivid blue light being given off at the various joints. Another instant, and a vivid stream of light shot across the sea to a number of ships lying in the offing at a distance of about two miles, lighting them up with the brilliancy and distinctness of broad moonlight. The effect was magnificent. Clouds of mists, rendered visible by the intensity of the rays shooting through them, rolled across the broad field of bright light from time to time, not, however, interrupting the view in their progress. By shifting the direction of the rays laterally, each object in turn came within the compass of the portion of horizon rendered clear. In fact, it was sufficiently apparent that no objects of any appreciable size, such for instance as an enemy's boats, could come within a mile or more of one of Siemen's dynamo-electric instruments in operation without being rendered conspicuous to any battery in the vicinity, and consequently involving to themselves the most imminent danger. Hence the result of the experiments may be pronounced a success; whether, however, a corresponding effect might not be obtained by a succession of parachute lights thrown from a rocket or mortar is quite an open question.

* Reprinted from the *Times*.

PHYSICS

Note on the Spectrum of the Aurora

ON the evening of November 9 there appeared one of the most magnificent crimson auroras ever seen at this place. When first observed, at about a quarter before six P.M., it consisted of a brilliant streamer shooting up from the north-western horizon; this was continued in a brilliant red, but rather nebulous mass of light, passing upward and to the north. Its highest points were from 30° to 40° in altitude. A white aurora, consisting of bright streamers, appeared simultaneously, and extended round to the north-east.*

The crimson aurora was examined with the spectroscope at six o'clock. The instrument used was a single glass-prism spectroscope, made by Duboscq, of Paris. On directing the slit toward the brilliant streamer above mentioned, a bright spectrum was observed consisting of five well-marked lines. A millimetre scale attached to the instrument was then illuminated with a gas flame, the auroral lines being readily measured, even when the numbers on the scale were bright enough to be read distinctly. The sodium line was used to adjust the scale, being equally divided by the division 100; the width of the slit was about one millimetre. As thus arranged, the five auroral lines, beginning at the red end, had the following positions:—Scale-Nos. 90, 110·5, 130, 138, 149. The brightness of the lines was, following the above order, 3, 1, 5, 2, 4, the second line from the red end of the spectrum being the brightest. The line marked 90 and the one marked 110·5 were sharp and well defined; the others were all nebulous on the edges. Before the measurements were completely verified by a second comparison, the crimson aurora entirely vanished, having endured less than half an hour. In the white aurora which remained, the spectroscope showed four of the five lines given; the crimson line alone was absent. The measurements are exact to half a division of the scale.

To determine the approximate wave-lengths of these lines, comparison was made both with certain metallic lines and with the lines of the solar spectrum. On the scale of this instrument the metallic lines employed read as follows:—

Kα 63, Liα 79, Srβ 80, H(c) 82, Caα 91, Srα 96, Caβ 113, H(f) 146·5, Srδ 163, Csβ 165, Csα 167, Rbα, & β 200, Kβ 218.

The Fraunhofer lines measured as follows:—

a 70·5, B 76, C 82, D 100, E 124·5, *b* 130, F 146·5, G 189.

Direct interpolation was used in comparing the wave-lengths of the auroral lines with those given above, the wave-lengths of the Fraunhofer and elemental lines being taken from Gibbs's tables (Amer. Jour. of Science and Arts, II. xliii. 1; xlvii. 194). This method was believed capable of giving results as close as the instrumental measurements. In this way the wave-lengths of the five auroral lines were obtained, as given in the following table:

Line.	Scale number.	Wave-length.	Auroral lines.	Other measurements.
B	76	687		
C	82	656		
(1)	90	623	623	627 Zöllner.
D	100	589		
(2)	110·5	562	562	557 Angström.
E	124·5	527		
(3)	130	517	517	520 Winlock.
b	130	517		
(4)	138	502	502	
F	146·5	486		
(5)	149	482	482	485 Alvan Clark, Jr.
G	189	431		

* Professor Newton informs me that he observed an equally brilliant red patch of auroral light in the north-east, five or ten minutes earlier. Since the lower end of the red streamers was much lower than that of the white, it would seem as if the red were seen through the white, the red being most remote.