numerous transverse trunks passing through the intervening muscular tissue, and the spaces between the septa were filled with a transparent glairy fluid.

The polyp-cells were exposed and solitary, resting on the internal surface of short branchlets strengthened by large dorsal spicula, one of which, much larger than the rest, extended considerably beyond the polyp-cells, tapering gently to a needle-like point. These latter spicula are covered with tubercles, and in every respect, but in size, similar to those of the general integument.

The small spicula on the internal or ventral surface of the branchlets diverge from one another in the peripheral direction, while those on the dorsal border are disposed longitudinally.

The mouth of each cup-like polyp-cell was surrounded with about eight projecting spicula, whose fixed extremities were curved upwards and inwards, festoon-fashion, while numerous smaller ones were so disposed as to fill up the open spaces posteriorly, and thus strengthen the body of the cell.

Although I have not been able to count the number of the oral tentacula satisfactorily, from their proportional size I can readily believe that there were about eight in this species, as in most if not all other asteroid polypes. They were broad and flat, tapering to a blunt point, like those of Sarcodyction (Forbes), to which genus I have no doubt this Zoophyte is nearly allied, though the habit of the polypidom is so very different.

March 19, 1857.

Dr. W. A. MILLER, Vice-President, in the Chair.

The following communications were read:—

I. "A System of Train-Signalling, by which also disabled Trains may telegraph for assistance without the aid of portable apparatus." By CHARLES V. WALKER, Esq., F.R.S. Received March 9, 1857.

(Abstract.)

When, in the early days of telegraphy, messages were sent and
trains were signalled on the same wires, no facilities existed for reducing the apparatus employed for the latter purpose, to a simple form. The case is now becoming different, special wires being largely devoted to train signals; hence the present system.

The instrument employed is a large electro-magnet, with a moveable armature, carrying a stem and a hammer, which latter strikes on a bell by the direct force of magnetism. It is provided with a contact-maker, a spring, the depression of which causes a current to circulate. The bobbins are 4 in. × 3 in.; and are filled with ten pounds of covered copper wire, No. 16 or No. 18. The core is of five-eight inch iron. The armature and appendages weigh 2½ oz. Bells of this kind have been in action for five years without cleaning or repairing. The battery is zinc-graphite, and a solution of 1 sulph. ac. + 8 or 10 water. The plates, 7½ in. × 3 in., are placed in stone pots that contain about a quart, the zinc standing in a gutta-percha slipper, containing mercury. Batteries of this kind will do their work untended for half a year and longer.

The language consists of blows on the bell; the number of blows varies according to the train-signal to be given. The distinctions required for ordinary purposes being few, the bell-language is very appropriate, from its addressing the ear, from its simplicity and from the facility with which the signals are given and taken. One blow is for the starting of an ordinary train; two, for an express; three, for the arrival of a train; five, for stopping all trains; six, for testing. This is a general code; other forms of code are used for protecting level crossings and junctions; but the fundamental signals of the general code are of universal application. This system was introduced five years ago on the South Eastern Railway; and at the present time consists of about 100 bells, to which additions are in progress.

The bells are connected in pairs, both bells being in a circuit that terminates in the earth in the usual way, at each station. The signal is made by depressing the spring from its earth-contact, upon the zinc end of the battery, the graphite end being in permanent connexion with the earth. The battery being thus introduced between the bell and the earth, a current circulates along the wire and produces one blow upon the bell. The home bell may be excluded or not from the circuit, when a signal is sent.
By the above arrangement signals are sent from station to station. But the extreme simplicity of the battery, the bell, and the language allows the arrangements to be so modified that signals may be made on a pair of bells from any joint, intermediate between two bell-stations, without the necessity of providing the signaller with any telegraph or battery, or any electrical apparatus whatever. The addition of this property to the bells does not in any way interfere with their being in perfect action and constant use for the ordinary work of train-signalling, and therefore if the guards of trains and the plate-layers of the permanent way are provided with a signal for expressing their wants, a great advance is made in telegraphy, and a large element of safety is gained for the travelling public.

It is well known to electricians that, if two equal and opposed currents are presented to the respective ends of a wire, no evidence is manifested of the circulation of electric force; the wire is in a null state, as much so as if no current was presented to it. Taking advantage of this law, in connexion with the simple bell-system above described, the circuit is made to contain the two batteries, one at each station, as well as the pair of bells; the same pole, the graphite, for instance, of each battery being connected with the earth.

When the home-station signaller desires to make a signal, he depresses the spring as before; but the connexions are such, that by this act he excludes his own battery from the circuit. The circuit then contains but one battery,—namely that at the pass station; the current of which is now able to circulate from end to end, being no longer counterbalanced by an equal and opposite current; and consequently the bells are sounded. This, then, is the process for ordinary train-signalling, under this arrangement.

By altering the contact-maker so that it inverts the battery in the circuit, instead of putting it out of circuit, both batteries are made available for each signal; and consequently the power and with it the cost of each may be reduced.

But the null state of the wire is equally well and very readily destroyed, by connecting it with the earth at any point intermediate between the two stations; for by this process a complete circuit is made or channel opened for the discharge of both ends of both batteries, each independently of the other, except that the attached wire between the earth and the telegraph wire is common to both
circuits, and thus the bells at the respective stations are actuated by the batteries of the respective stations. If ten blows with a pause of a minute, and then ten more, is the signal that the engine is disabled; ten blows, and a minute of contact, that an accident has happened; a ringing continued beyond ten, that the permanent way is obstructed, the stations at either side are advised and can take the measures necessary to meet the case.

These contacts may be made by hooking a wire or rod on to the line wire and making the necessary contacts with the rail; or, which is better, by establishing contact-makers, properly secured at frequent intervals on the telegraph posts.

This system gives to those in charge of disabled trains a certain means of asking for assistance from any point of the open railway, without any training beyond that of counting ten slowly and correctly. In practice, as between Red-Hill and Reigate, no inconvenience or loss of electricity has been suffered from counterbalancing the two currents.

The author states that there are other properties of opposed currents to be communicated on another occasion.

II. "On the Action of Aqueous Vapour in disturbing the Atmosphere." By Thomas Hopkins, Esq. Communicated by W. Fairbairn, Esq., F.R.S. Received January 2, 1857.

(Abstract.)

In this paper it was maintained that the great disturber of the equilibrium of atmospheric pressure is the aqueous vapour which is diffused through the gases. These gases, when ascending, cool (say 5°) through expansion by diminution of incumbent pressure, whilst the vapour that is within them cools only 1°; and a consequence is, that when a mixed mass ascends, the vapour is condensed by the cold of the gases. It is well known that condensation of vapour gives out much heat, and this heat warms and expands the gases when they are forced to ascend, taking vapour with them; and the process being repeated and continued, an ascending current is produced in the atmosphere, cloud is formed, the barometer sinks, rain falls, and winds blow towards the part.

This was shown to take place in all latitudes, producing disturb-