case an interesting exception was observed. A piece of iron which had not rusted on long exposure to the action of air and water was placed in a strong solution of copper nitrate; after some time beautiful crystals of copper were deposited on parts of the iron, whilst other parts remained quite unaffected.

SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

THE first of a proposed series of articles on this important subject by Mr. R. C. Mossman, of the Argentine Meteorological Office, appears in *Symons's Meteorological Magazine* for February. Notwithstanding the great labour involved in this kind of research, it has received increasing attention from leading meteorologists during recent years. Mr. Mossman has collected a large mass of material relating to the climate of South America, which is now available for testing whether the sequences of weather in that continent "show as pronounced resemblances or contrasts, when compared with data from other regions, as do those in the northern hemisphere."

The inquiry now in question refers to the relation between the Nile flood and the winter rainfall of Santiago (Chile). The data used for the Nile floods are the percentage values for the years 1869–1906, published by Captain Lyons in "Rains of the Nile," 1906, and, for rainfall, the percentage values at Santiago for May–August of the same years. When plotted on a diagram, it is seen that, on the whole, there is a strongly pronounced opposition between the two sets of values. The author points out that the winter rainfall of Santiago, in common with other stations between 32° and 39° S., varies with the position of the South Pacific high-pressure area.

The Chilean Meteorological Office has recently supplied a complete set of instruments to Juan Fernandez, and the island is in radiographic communication with the mainland. This, with observations from a new station on Easter Island (27° S., 109° W.), should, Mr. Mossman thinks, afford useful information regarding the seasonal relations of the South Atlantic and South Pacific anticyclonic belts, and later on, when these data are compared with those at St. Helena, there is little doubt that the chain linking up the rainfall of Abyssinia with the Antarctic circulation will be complete. Captain Lyons has shown that the height of the Nile flood is dependent on the June to September rainfall in Abyssinia.

SOME METHODS OF MAGNIFYING FEEBLE SIGNALLING CURRENTS.[1]

TELEGRAPHY over long submarine cables is continually on the increase, and I think it may be brought forward as a fairly accurate statement that the number of messages sent doubles itself every ten years. It is therefore important that, besides the increase in the number of the cables laid down each year, means should be devised to increase the carrying power.

The instruments which I have invented and am about to describe were designed primarily for cable work, but they are equally applicable to recording many other kinds of signalling impulses.

For good reasons, recording by photographic means is objected to by nearly every telegraphist. If the photographic method were permissible, great advances in speed would be available, but it is important that the record should be of a simple, cheap, and immediate nature.

Lord Kelvin invented the siphon recorder in 1867—that is, about forty-five years ago; he designed it so carefully that no improvement in its sensitiveness has been brought about until now.

Short Siphon Recorder.

In siphon recorders of the moving-coil type what has to be done consists of—

(1) Overcoming the inertia of the coil and siphon.
(2) Overcoming the back E.M.F. of the coil.
(3) Overcoming the control of the suspensions.
(4) Overcoming the friction of air, suspensions, and inking.

As the siphon has to return to zero in a certain time after the current in the coil ceases, it is necessary for the coil and siphon to have a definite frequency of oscillation depending on the speed of the signals. For submarine telegraphy this frequency lies between about 3 and 10 per second, and is adjusted by varying the control on the coil. As the control necessary to give a certain natural period to the moving system is proportional to its moment of inertia, it follows that by reducing this inertia we reduce the forces required both to accelerate the coil and to overcome the control.

The ordinary siphon recorder employed is a siphon tube about 2½ in. long and from 8 to 12 mils in

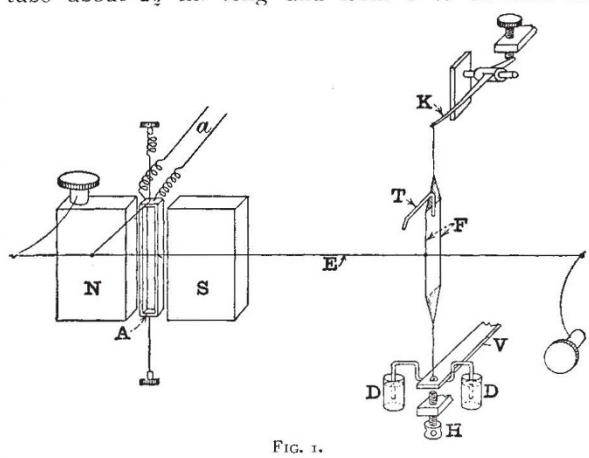

FIG. 1.

diameter. The moving coil consists of 500 turns of 2-mil wire at a mean radius of ⅜ in. The coil and siphon are mounted on separate axes and are connected by silk fibres so that the angular movement of the siphon is about two to three times that of the coil. By reducing the length of the siphon to ½ in. and substituting a narrower coil it is possible greatly to increase the sensitiveness of the recorder.

In order to make the inertia effects of the moving system a minimum, it is advisable to make them equal for the coil and the siphon. Even a narrow coil of 300 turns has about 100 times more inertia than the siphon, so that it is necessary to move the siphon through $\sqrt{100}$ times the angle moved by the coil.

By reducing the number of turns on the coil and increasing the field it is possible to reduce the natural period for a given sensitiveness and back E.M.F., but as the mass of the mountings and insulation of the coil only decrease slightly as the turns are reduced the gain is not very marked. In practice it is inadvisable to reduce the turns on the coil below 50 or 100 turns, as with lower values the power required to overcome the friction of the

[1] Discourse delivered at the Eighth Exhibition of Apparatus, held by the Physical Society on December 17, 1912, by Mr. S. G. Brown.