AN APPARATUS FOR THE MEASUREMENT OF ARRIVAL DIRECTION AND OCCURRENCE FREQUENCY OF ATMOSPHERICS IN OPERATION AT SHOWA STATION IN ANTARCTICA

Tetsuo KAMADA Susumu TOKUDA

Abstract

In order to study the atmosperics associated with the Polar Low Pressure, a self-registering direction finder for the source of atmospherics has been constructed. In this paper we summarise the scientific objective of the study and describe construction and performance of the equipment developed to achieve it.

1. Introduction

It has been experienced by the member of Japanese research expedition at Showa station in Antarctica that the observation of VLF emissions has often greatly been disturbed by strong atmospherics. The Japanese meteolorogists have suggested the possible origin of the atmospherics to be in the active polar low pressures.

The scientific objective of the study is to confirm the fact that the active polar low pressure actually involves an electrical activity in it. For this purpose, we intended to observe the arrival direction, and the occurrence frequency of atmospherics at Showa station, and constructed self-registering direction finder newly designed for the observation of atmospherics sources.

In the intention to separate near-by sources from distant ones, two different receiving frequencies (10 kHz for distant sources and 53 kHz for near-by sources) have been chosen.

The observation for distant sources of atmospherics has been carried out by Mr. S. Tokuda who is a member of the 10th Japanese Antarctic Research Expedition and the observation for near-by sources, will begin from April 1970 at Showa station.

2. Construction of the Equipment

A newly designed equipment is composed of the three parts, i. e., the uni-direction finding part, the direction read out part and the registering part. Block diagram of the equipment is shown in Fig. 1 and the outside view of it is shown in Fig. 2 and 3.

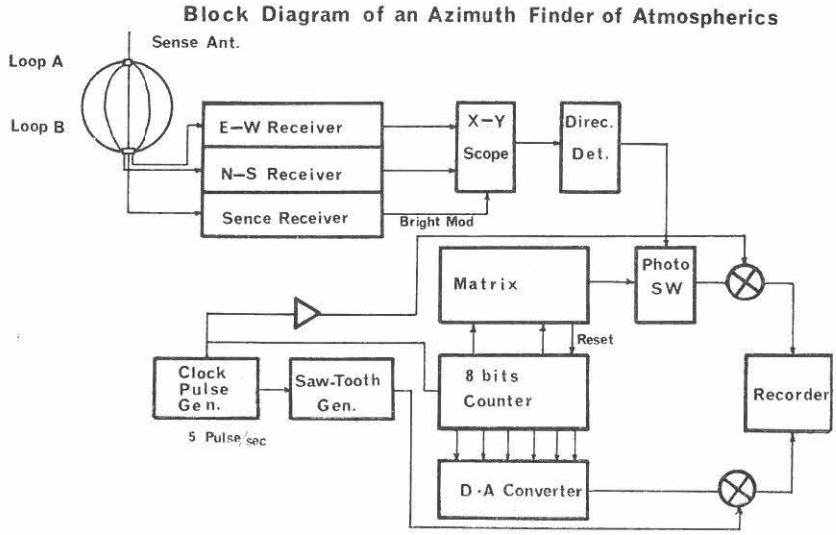

Fig. 1. Block diagram of a self-registering direction finder for the sources of atmospherics.

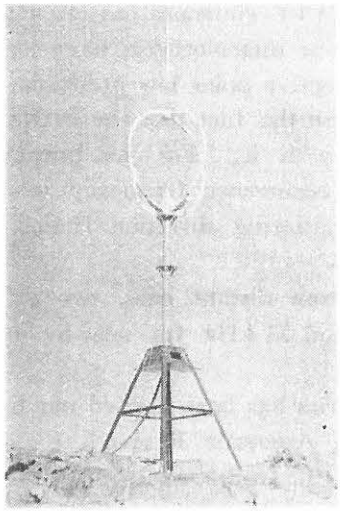

Fig. 2. The exterior view of antenna system.

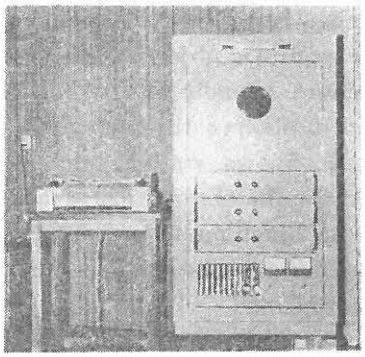

Fig. 3. The exterior view of equipments.

3. Uni-direction finding Part

This part is composed of the aerial system, the receivers, the test signal oscillator and the X-Y Syncroscorpe. The aerial system has a set of the same construction to the two different receiving frequencies and the each component is constructed respectivelly from a shielded crossed-loop antenna and a whip antenna for sensing, and connected with cable lines to the receiver. The component loop antenna has a diameter of 120 cm and the whip antenna has a length of 300 cm (see Fig. 2.).

The earth panel of the aerial system uses a radial metal mat, as shown in Fig. 4., to secure a good earthing on the rocky ground at Showa station.

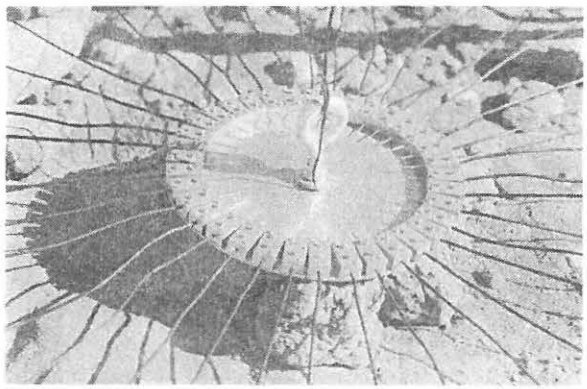

Fig. 4. The radial earth mat under the antenna system.

Each of the two receiver systems is constructed of three receivers of the same straight characteristics, which are shown in the table 1.

Table 1.

Receiving Frequency	10 kHz	53 kHz
Frequency Band	150 Hz	500 Hz
Overall gain	90 db for Loop antenna 130 db for Whip antenna	

The characteristics of test oscillator is as follows

Oscillating Frequency 10 kHz and 53 kHz
Oscillating time 1 ms/sec. (intermittent oscillation)
Out put Voltage 1—5 mV

The X-Y Syncroscorp used is of commercial type

4. The Direction Read-out Part

The part is constructed of detector, photo-Switch, Matrix circuit, 8 bit counter, D-A converter, clock pulse generator and saw tooth generator. (see Fig. 1.)

The directions are divided into thirty-six segments each of which covers an angle of 10°. (see Fig. 5.). The read-out element of the 36 segments composed of 36 solar cell elements whose arrengement is shown in Fig. 7. The read-out time of one direction is 10 sec., so the total read-out takes 6 min.. The switching mechanisum of the output of different directions used is of the non-contact electrical switching system.

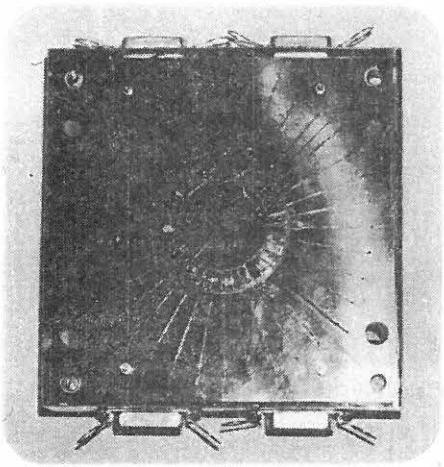

Fig. 5. The view of the read-out element.

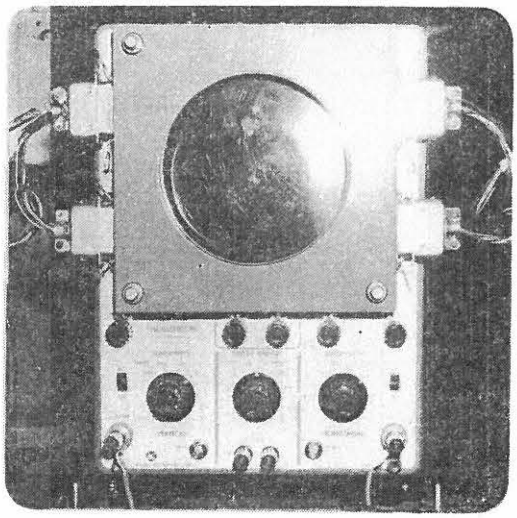

Fig. 6. The front view of the read-out part.

5. The registering Part

The registering uses the pen-recorder of commercial type which is shown in Fig. 3. The sample of the registering of atmospherics is shown in Fig. 8. The axis of ordinate indicats the time and the axis of abscissa indicate the azimuth. The occurrence frequency is indicated by the density of the spike output pulse.

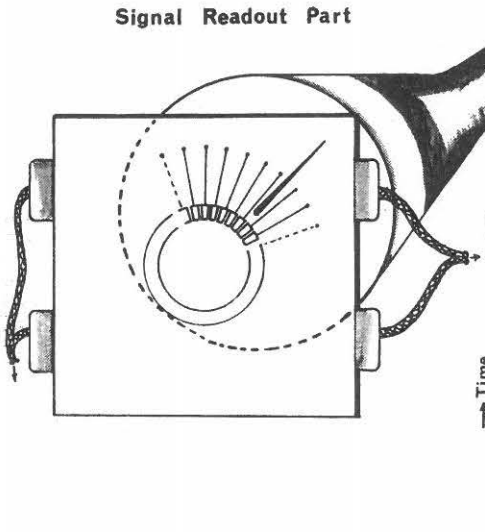

Fig. 7. The arrengement diagram of the read-out element.

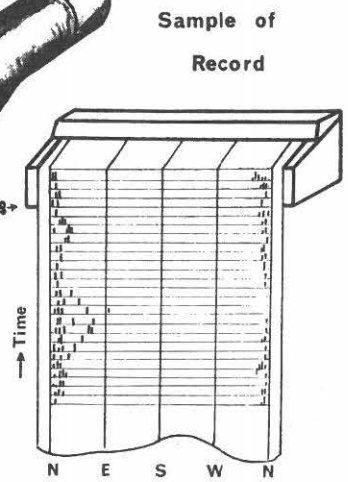

Fig. 8. The schematic diagram of the registering part.

6. Acknowledgement

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