AUTOMATIC DIGITAL REGISTRATION OF GEOMAGNETIC FIELD PARAMETERS

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The paper presents the concept, method, technical know-how, flow-chart, and operation algorithm for digital registration of geomagnetic field parameters. A solution of the problem is suggested, based on identification of the individual time domain parameters during the registration process at times of geomagnetic storms and subsequent disturbances, particularly in cases where, as a result of great amplitudes of the detection signal, record traces intersect and interweave with each other.

Currently, in a number of geomagnetological observatories all over the world, the classical photoregistration method of geomagnetic field (GMF) parameters is used: declination D, horizontal intensity H, vertical intensity Z, and total vector F. The processing and interpretation of this data involves a number of manual and labour-consuming operations – film development, fixing, and drying, visual reading of the analogue record etc. Moreover, with registration of geomagnetic storms (Fig. 1), on account of the great record amplitudes, the traces of the individual

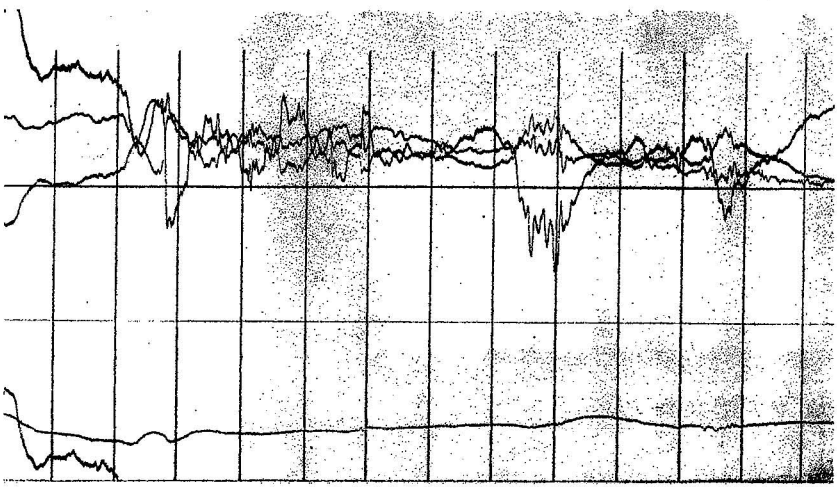

Fig. 1

parameters intersect and interweave with each another (Fig. 1) which greatly embarrasses these records interpretation.

Geomagnetic parameters can also be measured and registered by proton magnetometers, but these devices are still expensive, complicated, and delicate.

The paper provides a brief description of a method and hardware for Digital Registration of Geomagnetic Field Parameters. Fig. 2 shows the overall operation diagram of the equipment. On diaphragm 2 of photoregistration unit 1, a photodiode ruler 1 is mounted. It is a complex one, consisting of four individual rulers positioned in the following way with respect to diaphragm 2: 1 and 1 – immediately behind it, and 1 and 1 – below it. This positioning of the rulers makes it possible to null their inactive side sections, providing in fact a continuous photodiode ruler throughout the entire length of the diaphragm. Light rays 8 from collimators 5 reflected by sensors 9 are focused in the form of a hatch onto the diaphragm. The medium part of these blicks effects the analogue photo record itself. The unused sections (for 8^{I} and 8^{III} – the upper ones and for 8^{II} and 8^{IV} – the lower ones) fall within the appropriate photo diode rulers 1.

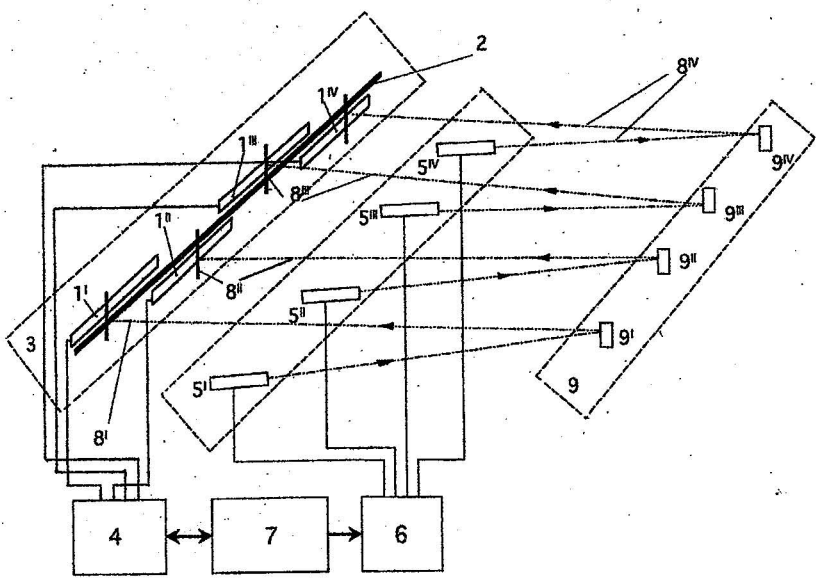

Fig. 2

The outputs of 1 are connected to a preliminary signal-processing block 4 which has a two-way connection with microprocessor system (computer) 7.

Moving along diaphragm 2 and effecting the analogue photo record, blicks 8 fall as well onto the appropriate elements of photo diode ruler 1. The signals from 1 are fed to the preliminary signal-processing block, and from the signal-processing block – to computer 7.

The problem for identification of the individual components record traces at times of geomagnetic storms is resolved in the following way: collimators 5 are not fed continuously by their power-supply block 6, but after a special cyclorama issued by the microprocessor and illustrated in Fig. 3. In the preliminary version, the following cyclorama (Fig. 3-a) is used:

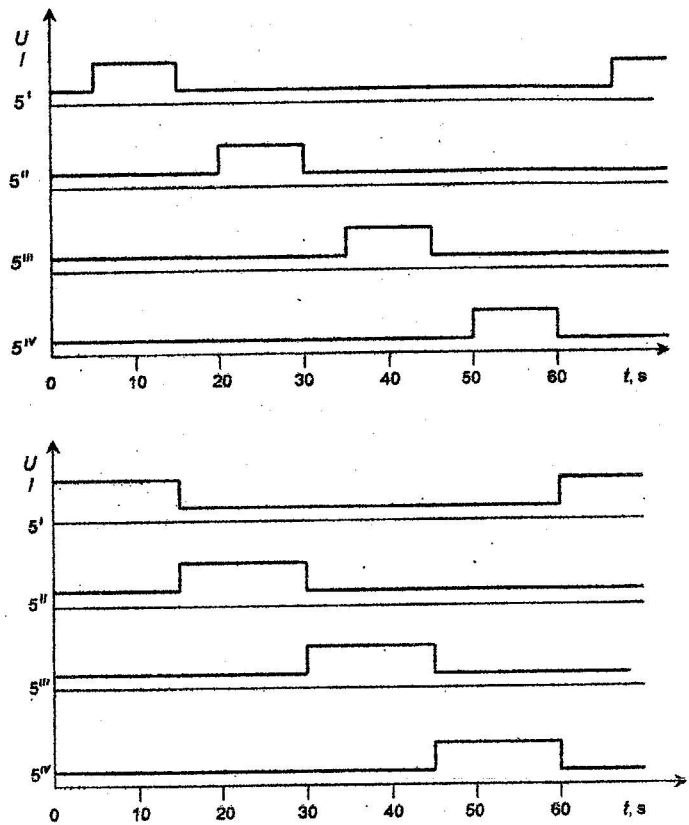

Fig. 3

Table 1

Time s		Supplied electric voltage to collimator	Registered GMF component
from	to		
5	15	5^{I}	***D***
20	30	5^{II}	***H***
35	45	5^{III}	***Z***
50	60	5^{IV}	***F***

As can be seen, the registration of each GMF component is interrupted for 50 s which, minding the standard registration velocity of magnetological photo registration units (V = 20 mm/h) is manifested as trace interruption of 0.28 mm. This interruption is of the same order of magnitude as human eye resolution, therefore, it does not embarrass nor distort visual interpretation of the analogue record. Digital data is not lost either, because within a 50 s interval, GMF parameters remain actually unchanged. Nevertheless, in a later version of the equipment, another cyclorama is tried (Fig. 3-b) where the components magnitude is registered for 15 s, and not registered for the other 45 s accordingly. In this latter case, synchronously with the registration of one component, the registration of the next one starts.

The advantages of the suggested equipment lie in the fact that digital recording takes place automatically on-line, not disturbing possible photoregistration. Due to the fact that it is provided by one and the same sensors, this digital registration is fit for joint processing with the multi-year analogue magnetological registration. Labor-consuming manual operations are escaped and expensive photo paper and chemicals are saved. Electric power is saved as well which is a fact not to be neglected minding that geomagnetological observatories are powered entirely by accumulators.

The method and system design for Digital Registration of Geomagnetic Field Parameters is subject to copyright.

REFERENCES

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