PHOTOELECTRIC DEVICE FOR TO MEASURE EFFECTS
IN GRAVITATIONAL COMPUTATIONS

by Tibor Dombai (*)

Measurements of practical purpose carried out with Eötvös Torsion Balances and gravity meters are performed in order to be able to infer upon the spacial distribution and structural features of the rocks forming the earth's crust. On account of several reasons it is a very complex task to conclude out of the experimental results upon the effects itself. In the present paper I will confine myself merely to solve the question under circumstances related with the computations.

The greatest difficulty in determining the gravity effect lies in the fact that the solution of the problem is uncertain on account of potential-theoretic considerations. We have to resort to the method of repeated alterations, i. e. to change along the spacial position and shape of the structure assumed as being responsible for the effect, until the gravity effect of the presumed type of structure does not satisfactorily agree with the measured results. Accordingly even a person of great routine has to perform several times the computations.

A great simplification of computations is achieved if we assume two-dimensional effective masses, because the formulae obtained for two-dimensional gradually inclined trends leads to an easy way of reckoning. Therefore in the first investigations it was generally assumed that the formation causing the gravity effect has such a structure. Since it was of necessity to compute in every point of the surface the effect of every single inclined grade of the presumed structural configuration, a simplification was introduced by using appropriately constructed numerical tables.

N. Szécsödy and J. Renner have constructed in 1936 an extremely simple and easily realisable device for to measure gravity effects of structural configurations built up out of two-dimensional gradually inclined trends. The device consists mainly out of a goniometer. Upon the sides of the instrument we indicate the lognat of r, occurring in the formulae of

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the gravity effect of gradually inclined trends and upon its are the absolute values of the visual angle of the slope is plotted.

The second step of simplification is represented by the counting diagrams. The first diagram was published by K. Jung in 1927. But already in 1928 H. Haalck constructs a second kind of diagram. Fr. Breyer gave in 1939 a good survey of one part of these possible diagrams.

I should like to point out that the counting diagrams have not only the significant advantage — although establishing only approximative values — that the calculations can be completed in a much shorter time, but they represent a development also from the point of view that by their application we are not confined to build the boundary surfaces out of planes, but we may as well use curved surfaces and moreover we may treat the whole question as a three-dimensional problem.

The integrator constructed by W. Schwydar and reviewed in 1932 by F. Kasselitz eliminates the defects consisting in the tiresome and obviously often erroneous counting of the diagram-fields. The integrator is endowed with the further advantage, that except for the inevitable experimental errors, it enables the determination of the \( U_z \) and \( U_{xz} \) differential quotients for any two-dimensional structural configuration having whatever kind of boundary surfaces. It has, however, the disadvantage that it can determine only the gravity effect of two-dimensional configurations and that in every point in which we want to know the effect we have to proceed with the needle of the integrator around the whole configuration.

In the subsequent part I should like to describe the working mechanism of such a device in which the counting of the effective fields of the counting diagrams is achieved by means of photoelectricity. The counting device can be applied to any kind of counting diagrams, provided only that they are appropriately adjusted.

The following adjustment of the diagrams is required: instead of drawing the diagrams in the usual manner, we have to put in every field of the diagram a black spot of a surface equal to the surface of the smallest field. In case we should want to proceed with greater accuracy, we may put in the larger fields more than one black spots equally distributed, we have only to take care that the total area of the black spots should not exceed the surface of the smallest field. Making a photographic picture of this black point-diagram upon a very hard photosensitive plate, we will see white spots upon a black background.

Let us now illuminate this transparent point-diagram with a parallel beam of light and project with the help of objectives (\(*)\), appropriately cut out of a simple spherical lens, the points of common sign of the diagram upon photocells: those of positive value upon one photo-cell and those of negative value upon another. We join now these photo-cells through suitable amplifiers to an ammeter in the way that it should register the current differences of the two photo-cells. Covering the diagram with a membrane which is transparent at places where the configuration has a

\(*)\) If we use only the hemi-space below the horizontal plane we need only one objective lens for the construction of \( U_z \), two for \( U_{xz} \) and three for the \( U_{xx} \) diagrams.