DOCTOR GASSER'S OPTICAL PROJECTOR

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The appliance for plotting by double projection of pictures invented by Dr. GASSER (Fig. 1) is one of the appliances now in use for stereoscopic employment of vertical photographs taken from aircraft. By means of this appliance the restitution of the picture in space can be examined and reproduced without any intermediate optical system.

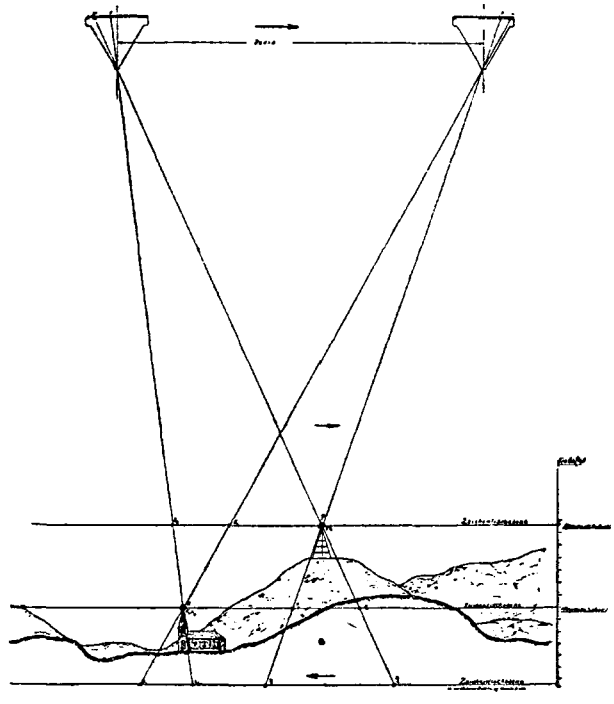


Fig. 2.

Diagram shoving the paths of rays for two exposures on an uneven ground

Figure 2 will explain the apparatus in diagrammatic form. The two cameras shown in the upper part of the diagram represent two points of exposure. The plane, provided with a camera, makes flights over parallel bands of territory and takes series of photographs at the desired intervals, and thus pairs of photographs with the necessary stereoscopic overlap are obtained. The rays of light which issue from the various points of the ground, and which reach the plates after passing through the objective, lie at angles to the optical axis the size of which depends on the position and the altitude of the points of the ground with reference to the points where the exposure was made.

The object of this appliance is to reconstitute the conditions at the time of exposure, in other words to give the two cameras the same relative positions in space which they occupied at the moment of exposure and direct the rays back again at the same angles at which they arrived. When this "reciprocal orientation" has been carried out, "absolute orientation" is then made in accordance with the control points, whose position and altitude are known.

Though the inventor, Dr. GASSER, proposes a procedure for the "absolute orientation" in which the nadir of the photograph is determined by means of special perforating appliance du-

ring the orientation, the Hansa-Luftbild G.m.b.H. uses a special process which was suggested during the use in practice of the instrument. This process should allow the number of control points determined on the ground to be reduced. Tests made by the Hansa-Luftbild G.m.b.H. are not yet sufficiently advanced to allow the practical advantages of the use of the nadir to be estimated.

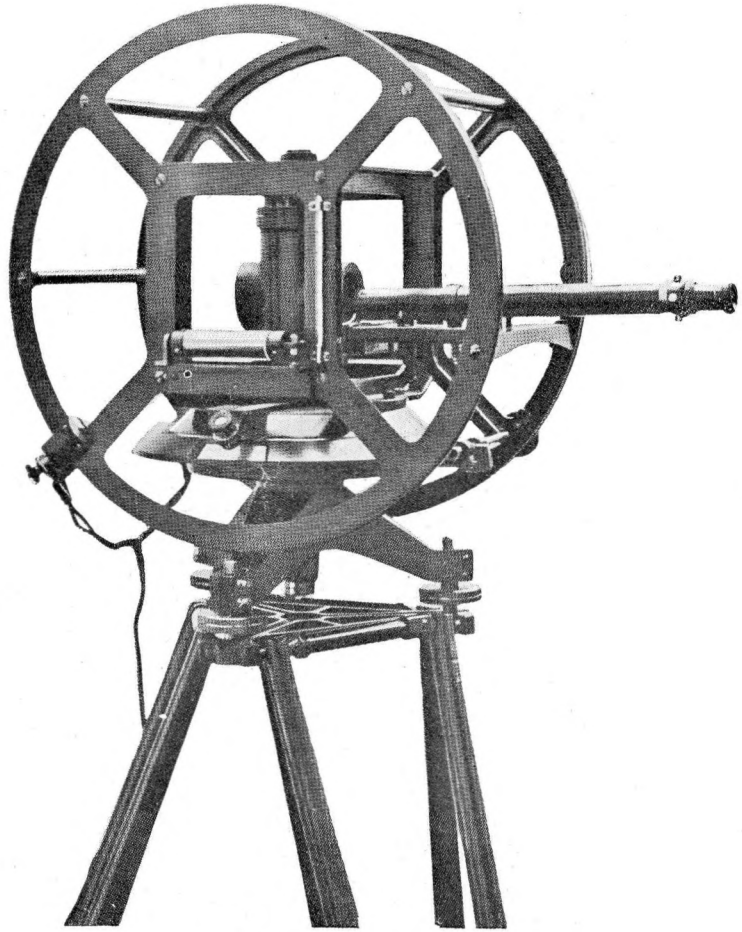
When the two photographs are projected on to the table a confusion of lines and of indistinct and woolly looking points is seen. This is due to the fact that the surface of the table is not in the sharp focus plane but roughly 25 ‰ below it. It is easy to give the reasons for this; in order to obtain an exact horizontal projection, each point should be drawn in at the point of intersection of its rays (Fig. 2.). To do this the whole table would have to be raised or lowered, but in order to avoid such movements the actual drawing surface is placed lower down, and small substitute tables are used as intermediaries (Fig. 1). These small tables can be moved very easily and the amount of movement can be read directly from a scale, which will also assist in setting them. The plane of the small table is fitted with a measuring index below which, and concentric with it, there is a position pricking device. Points or lines which are measured with the index mark may thus be transferred at will on to the true drawing surface. To find a position thus, the flash method is used, *i. e.* the two plotting projectors are not lighted up simultaneously but alternately, and thus the image becomes "alive". All the points whose projections do not coincide jump from one place to another and, by moving the substitute tables, this jumping effect can be annulled, then it is possible to fix the point dealt with and it can be pricked in by the pricking devices. Thus, point by point, the whole can be fixed and all the lines inserted, but naturally care must be taken that, during the work, the substitute table is definitely set in accordance with the altitude of the ground; in other words that fixing can be continued without the points jumping about. In this way the whole of the view taken can be restituted and inserted on the chart.

Altitudes are represented by means of contour lines which are not interpolated but are drawn in directly. The drawing of these lines is done as follows:- the height of each contour is applied to the substitute table by means of its scale and the line, thus set on the scale, can be followed, drawn in and entered on the chart, all points on it being perfectly still. All the lines are drawn thus one after another until the whole of the chart has been completed.

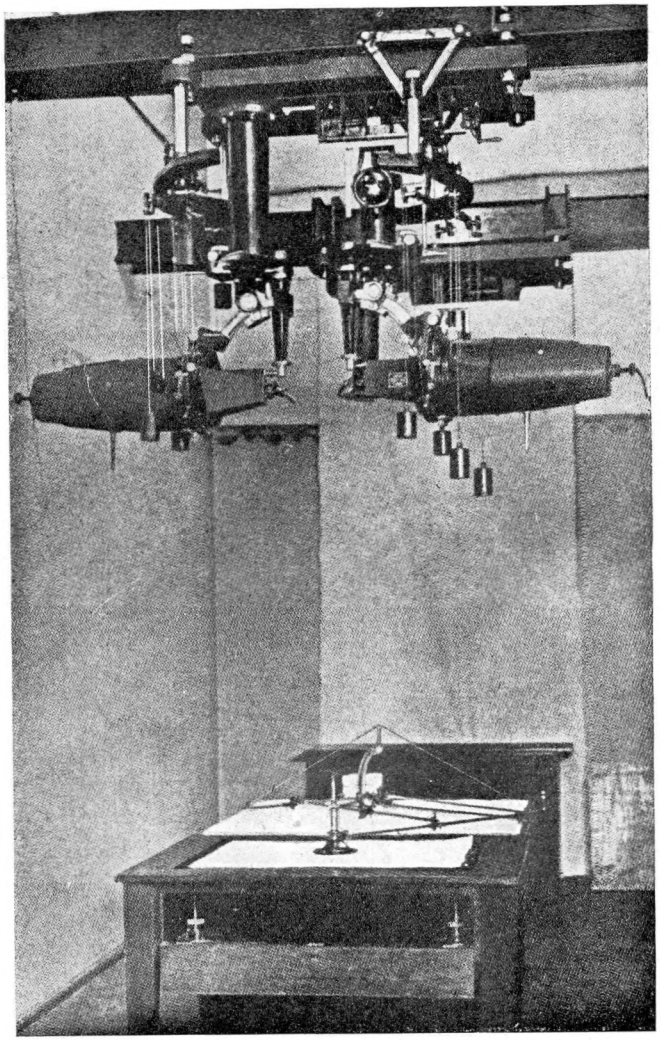
The double plotting projector allows another method of examination to be used, which likewise serves for the purpose of fixing. This is the anaglyph process invented by the German physicist ROLLMANN in 1853. By the interposition of red and green filters before the objectives two projections are obtained, one of which is red and the other one green and these two are projected on top of each other. If these red and green pictures be looked at through red and green glasses corresponding to the filters used, the two images can be separated in such a way that each eye in effect sees one image only and thus the conditions for stereoscopic vision are fulfilled and the whole photogrammetric form becomes visible.

On account of the enlargement, which is about as one is to six, the double projector is principally of use for the restitution of charts of large scale (1:1000). For this reason the tests, carried out by the Hansa Luftbild G.m.b.H. with this instrument, deal with the drawing of charts of this type only.

Thus according to the tests so far made, the result of the drawing is a chart on a large scale, but roughly determined. This scale is definitely determined from a known distance on it, and the whole chart has to be redrawn to be brought to the desired scale. So far as the perfection of the restitution is concerned it may be said, from the trials actually carried out, that the accuracy of the positions has always fulfilled requirements, and the accuracy of the representation of heights *in open ground* has been sufficient during these tests, though *in less open and not easily recognisable ground* some differences have been found occasionally, due partly to imperfect work and partly to imperfect recognition of the details of the territory. The trials are being continued, as it is impossible to draw any definite conclusions or to make any general statement from those so far carried out. From the financial point of view the same thing may be said, though there is no doubt that, if used with discrimination, it has advantages over the usual ground work even on the largest scale. However it is impossible as yet to draw up rules on this subject.



Ordnance Survey Magnetometer
Magnetometre de l'Ordnance Survey



Dr. Gasser's Optical Projector Fig. 1
Appareil de Projection du Dr. Gasser