III. A METHOD FOR DETERMINING DISTANCE AND HEIGHT OF OBJECTS BY USE OF A CAMERA

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When doing reconnaissance work in the field it is often inconvenient to carry very many instruments. Ordinarily one requires a camera, and the following method explains how it can be used as a primitive surveying instrument. A very fine scale is ruled on the ground glass, and the length of the image of a distance object (A_1) is accurately determined by means of a hand lens. The camera is then moved some given distance toward the object and the length of the image (A_2) is again determined. Having the length of the images, ($_1$) and (A_2), the focal length of the camera (f), and the distance the camera was moved, (X), it is possible to determine the height (H) of the distant object and the distance (D) it is from the observer by use of equations, the algebraic development of which follows:

$H:D :: A_1:f$ similar triangles

thus $fH=A_2D$

$H: (D+X) :: A_1:f$ similar triangles

thus $fH=A_1 (D+X)$

$A_2D=A_1 (D+X)$

$$\frac{A_2D}{A_1}=D+X$$

$$\frac{A_2D}{A_1}-D=X$$

$$\frac{A_2D-A_1D}{A_1}=X$$

$$\frac{D (A_2-A_1)}{A_1}=X$$

$$D=\frac{A_1X}{A_2-A_1}$$ final equation

$A_2D=fH$; then $D=\frac{fH}{A_2}$

$\frac{fH}{A_2}=\frac{A_1X}{A_2-A_1}$; then $H=\frac{A_2A_1X}{f(A-A_1)}$ final equation