N° 14,998 A.D. 1911

Date of Application, 27th June, 1911—Accepted, 25th Jan., 1912

COMPLETE SPECIFICATION.

Improved Surveying Instrument.

I, HUGO MÜLLER, Builder, of Neusalz, a small town in Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a portable distance or range finder for accurately and expeditiously determining the distance, from the observer, of any object providing one of the dimensions, say the length, of the latter is known.

It has previously been proposed to provide a tacheometer with an eye-piece and a kind of camera obscura which shows an image of a distant object, while suitable adjustable scales give the readings of distances.

According to my invention the apparatus which is made in the manner of a camera obscura on the focusing screen of which shows the picture or image of the object whose length is known, has two sliding arms adapted to be carefully adjusted against the extremities of said picture. The lens of the camera is stationary and so ground and set as to leave an intervening distance from its centre to the focusing screens of any tenfold of the unit of the measuring scale employed.

For measuring the distance of an object, the proportional sides of similar triangles are taken into consideration, two sides of which are formed by the outer lines from the ends of the object and intersecting one another in the centre of the lens while the third side is the length of equivalent line of the object and with which the line of the picture is parallel. Thus, the distance of the target is in proportion to the distance of the picture from the centre of the lens. As the latter distance is ten units, *viz*: 10 centimeters, it will be only necessary to suitably shift the decimal point in order to obtain the multiple, after which the real distance of the object can be ascertained from the division of two values, being the size (length) of the object divided by the size (length) of the picture. The result can be read off a slide rule which is fitted on the focusing screen.

The accompanying drawings show the apparatus complete and in detail.

Fig. 1, is a perspective view of the apparatus, portions being broken away for economy of space.

Figs. 2, and 3 are a fractional front view and vertical cross-section respectively of the measuring device shown to a larger scale.

Fig. 4, is a diagram illustrating the result of the operation.

The camera obscura *a* is fitted at two rectangular sides with screws *b* and *c* so as to be fixed on either side to a tripod *d* in order to have the slide rule and the scale horizontal or vertical as may be desired. The rear of the camera contains the focusing screen while the lens is rigidly fixed at the front of the camera *a* at the distance of ten centimeters, the lens being so ground as to throw a sufficiently clearly defined picture on the screen.

The size or length of the picture can be readily determined by means of

[*Price* 8*d*.]

sliding rules *g* and *h* connected with a frame *f*. Of these sliding measuring rules, the rule *h* has divisions of centimeters with sub-divisions. On the rule *g* are slidably mounted two arms *i* and *k* which stand at right angles to said rule and which are slid from both sides towards the picture until they coincide with the extreme point of the latter. The inner ends of the arms *i* and *k* rest against the rule *h* and so indicate the length of the picture on the scale of the rule *h*. The centimeter divisions start from a middle zero-point in opposite directions, and the measures indicated by *i* and *k* must be added so as to give the total length of the picture. Both arms *i* and *k* can be individually moved along the rule *g*, while, moreover, the arm *i* can be moved towards *k* by means of a screw *l* secured to the arm *k* which screw works in a nut l^1 clamped to the arm *i*. When the set screw is loosened from *i* the nut l^1 can be shifted without taking the arm *i* with it.

For setting the arms, it is advantageous to loosen the nut l^1 by releasing the set screw thereof, then pushing the arm *k* to the near end point of the picture and then fixing the arm. Next, the set-screw is tightened so as to clamp the nut l^1 on the screw *l* against the arm *i* and the screw *l* is then turned so as to bring the said arm *i* against the other end of the picture. The scales are denoted by the reference characters *m*, *n* and *o*, their use being hereinafter explained.

Referring to the diagram shown in Figure 4, *s* is the centre point of the lens, and *x*, *v* and *y*, *u* are the extreme lines or rays from the object, while *x*, *y* denotes in meters the size or length of the object of which *u*, *v* is the corresponding size in centimeters of the picture. Therefore *r*, *s* is the distance in meters of the object from the centre of the lens and *s*, *t* is the distance of the focusing screen from the centre of the lens which is here ten centimeters.

As the two triangles are similar to each other the following equation can be made.

$$\frac{x\,y}{r\,s} = \frac{u\,v}{s\,t} \text{ or } r\,s = \frac{x\,y \times 10}{u\,v}$$

That is to say the distance of the object in meters is equal ten times the size of the picture in centimeters.

If the distance of a ship from the observer is to be ascertained when the length of the ship is known to be 275 meters and the length of its picture on the focussing screen is found to be 2 + 1.15 = 3.15 centimeters, then by the afore-said equation, the result will be:

$$\frac{275 \times 10}{3.15} \text{ or approximately 873 meters.}$$

To enable the result of the division to be read off the scales, a logarithmic slide rule *m*, *n*, of known construction, is combined with the scale *h* in such a manner as to connect *m* with *i* while *n* moves in guides along *m*. With the aforesaid example, the point *o* on the rule *m* gives the length of the picture 3.15 c.m. The rule *n* is then adjusted so that the point, denoting the known length 275 m. of the object, coincides with the point *o* after which the numeral 1 on the rule *m* indicates on the rule *n* the distance of 873 m.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

A portable distance or range finder which consists of a camera obscura fitted with a focusing screen at the rear and a stationary lens in the front at a distance of any tenfold of the unit of the measuring scale so that the picture of any object under observation, of which one dimension is known, is thrown on to

the screen and can there be taken with its end-points between two slidable arms connected with logarithmic slide rules which give the distance or range of the object from the observer, substantially as hereinbefore described with reference to and shown in the accompanying drawings.

Dated this 27th day of June, 1911.

CHATWIN, HERSCHELL & Co.,
London, W.C.,
Patent Agents for the Applicant.

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MULLER'S COMPLETE SPECIFICATION.

(1 SHEET)

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

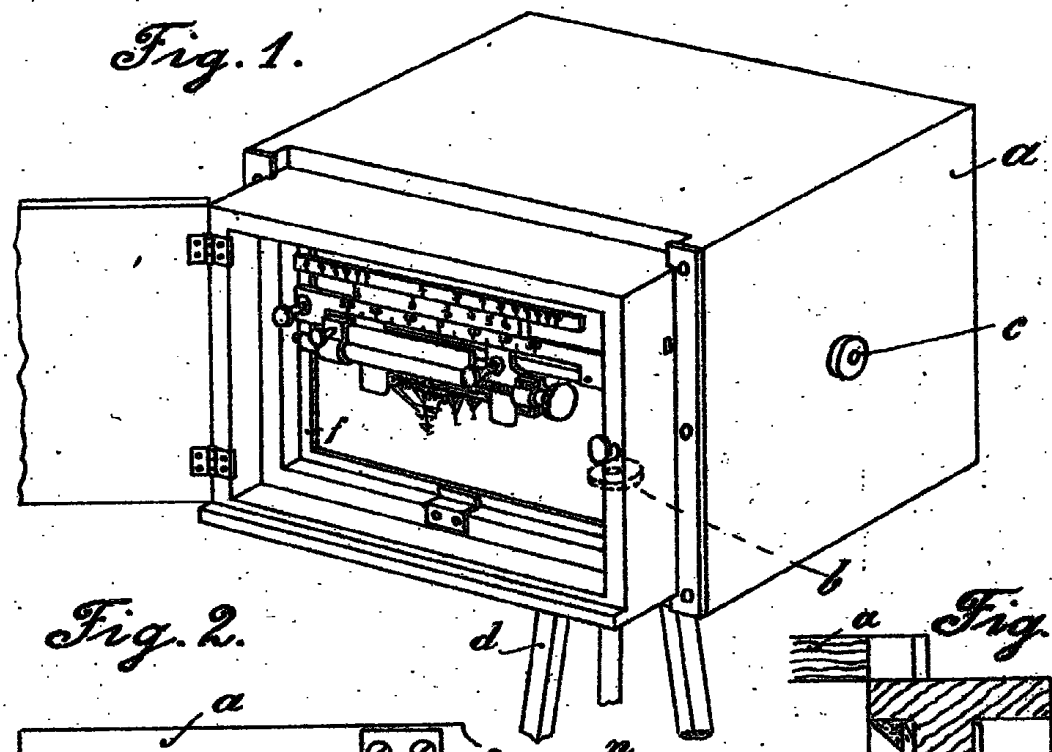


Fig. 2.

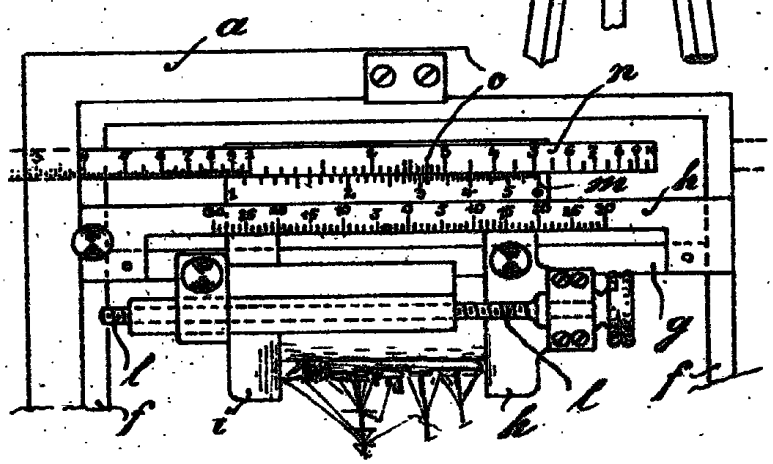


Fig. 3.

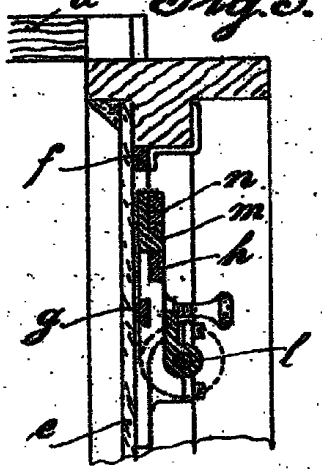
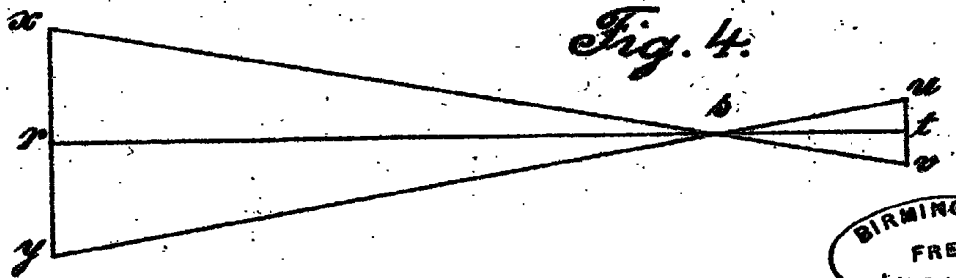


Fig. 4.



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