A. KÖNIG.

SEPARATING PRISM TELEMETER.

APPLICATION FILED APR. 28, 1908.

940,166.

Patented Nov. 16, 1909.

2 SHEETS—SHEET 1.

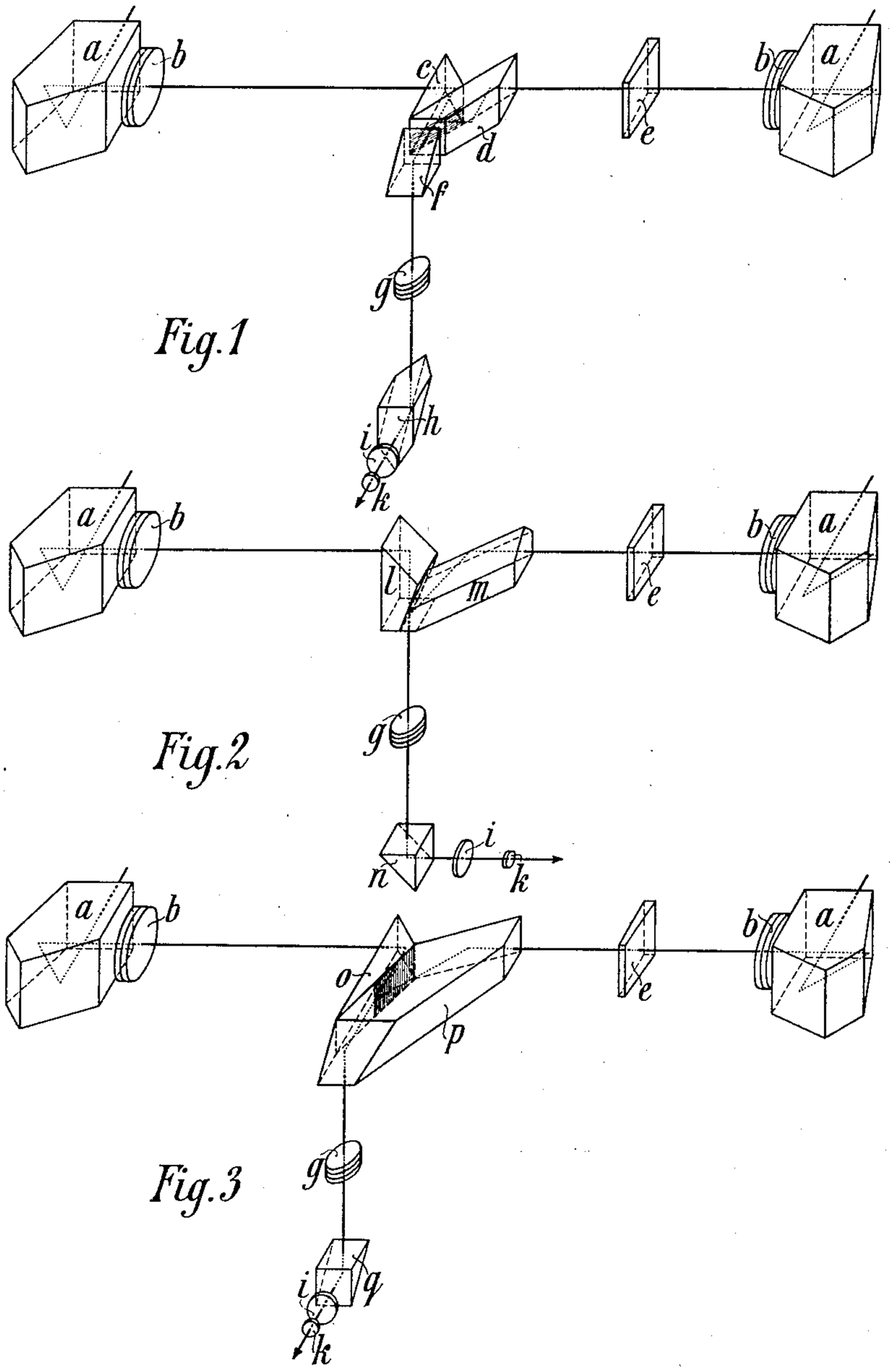

Fig. 1

Fig. 2

Fig. 3

Witnesses:

Paul Krüger

Fritz Sander

Inventor:

Albert König

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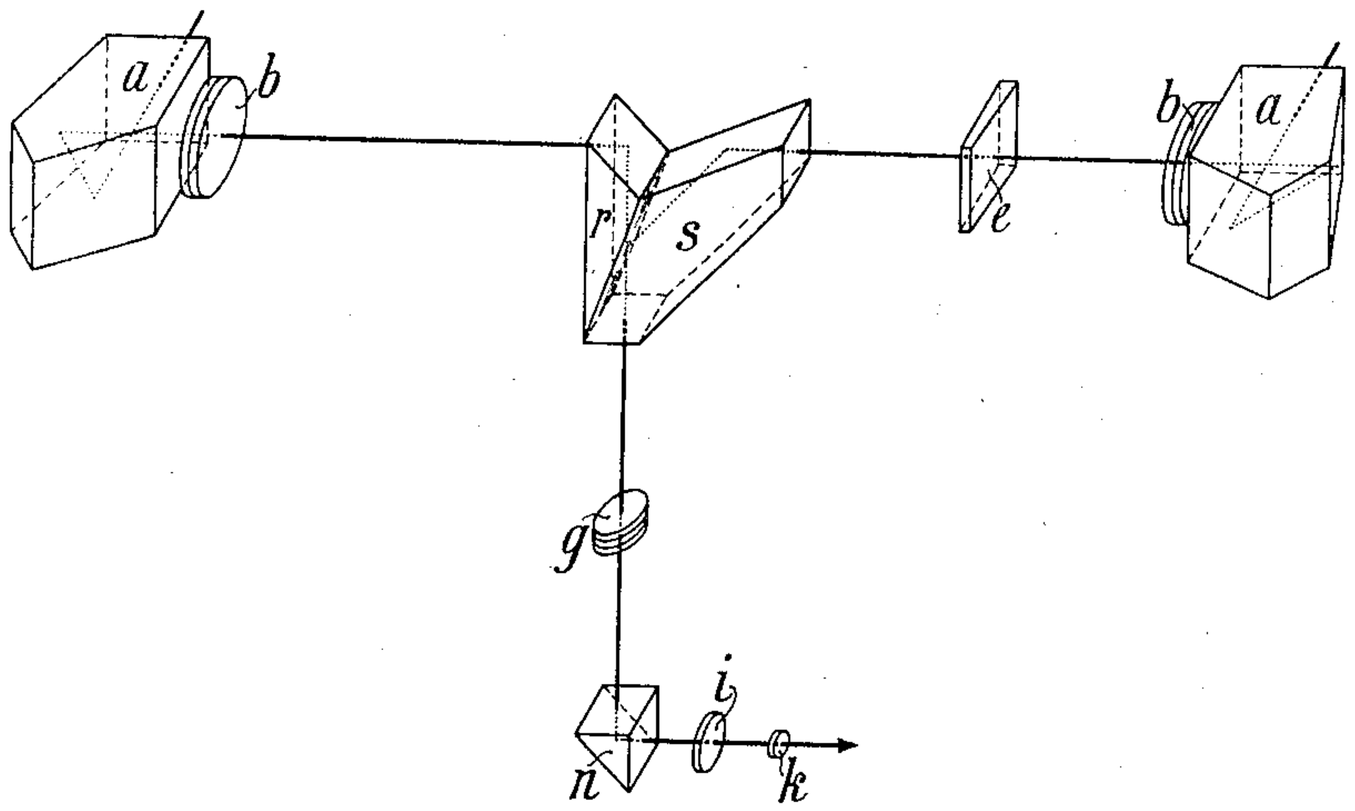

Fig. 4

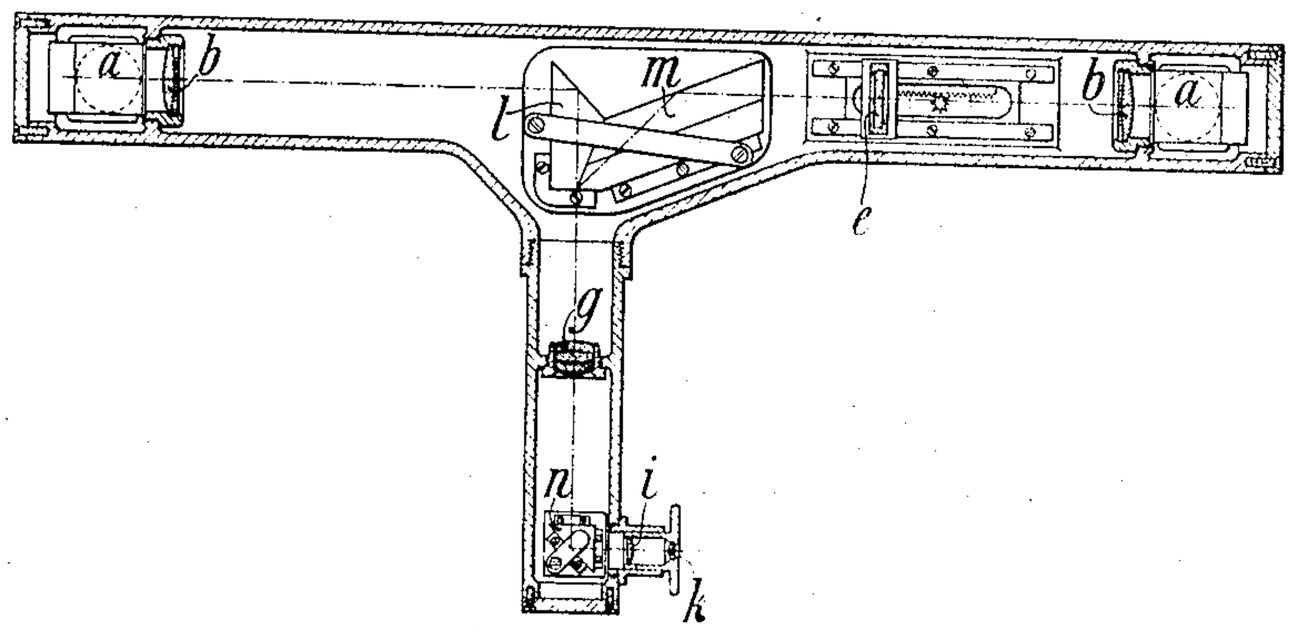

Fig. 5

Witnesses:

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UNITED STATES PATENT OFFICE.

ALBERT KÖNIG, OF JENA, GERMANY, ASSIGNOR TO THE FIRM OF CARL ZEISS, OF JENA, GERMANY.

SEPARATING-PRISM TELEMETER.

940,166. Specification of Letters Patent. **Patented Nov. 16, 1909.**

Application filed April 28, 1908. Serial No. 429,613.

To all whom it may concern:

Be it known that I, ALBERT KÖNIG, a citizen of the German Empire, and residing at Carl-Zeiss strasse, Jena, in the Grand Duchy of Saxe-Weimer, Germany, have invented a new and useful Separating-Prism Telemeter, of which the following is a specification.

The invention relates to telemeters having two objectives, a common ocular and a separating prism system. Two such kinds of separating prism telemeters are known: the coincidence telemeter in the narrower sense of the word and the symmetry telemeter according to our application for patent, filed June 23, 1906, Serial No. 323,164. The invention extends to both the said kinds, but only where the instrument has a horizontal base line and the entrance pupils elevated so as to enable observations being made and measurements taken over some obstacle sheltering the observer.

The invention consists in a general arrangement for such telemeters, which is very simple and retains the approved arrangement of the ordinary instrument, having non-elevated entrance pupils, for those parts, upon the position of which the accuracy of the measurement depends.

A coincidence telemeter with separating prism system and elevated entrance prisms has been already touched upon in the patent specification 661968 (page 2, column 1, lines 50 to 54) in connection with the detailed explanation of a telemeter, whose base line is also horizontal and whose single objective has a vertical direction of axis and lies below the level of the entrance prisms. With reference to the arrangement of the coincidence telemeter with elevated entrance prisms incidentally mentioned, there is nothing set forth except that the separating prism system serves at the same time for reërecting the images (page 2, column 1, lines 37 to 39). The simple solution of the same problem is according to the present invention based upon a lens inverting system erecting the images projected by the objectives. By such a system an astronomical telescope is in general elongated by a length equal to four times the focal length of the system. If in the present instrument this length, which extends from the image plane of the objectives to that of the ocular, be given a downward direction for the whole or a greater part of the way, it supplies in itself—in suitably choosing the focal length of the inverting lens system—the required difference in level between the exit pupil and the entrance pupils. From that it follows, however, that all those optical parts, which have influence upon the relative position of the images produced by the objectives, that is to say, in all cases the objective prisms and the separating prism system as well as the objectives, preserve the same identical level and can be assembled in a rigid tube system as in the ordinary instrument with non-elevated entrance pupils. But the position of the separating prism system can deviate so far from the ordinary one as to permit uniting of the optical axes by this system also in a vertical plane. The united axis need then only be deflected once again by reflection, to make it horizontal and available as the ocular axis.

In the annexed drawing: Figure 1 is a perspective diagram of a coincidence telemeter constructed according to the invention. Fig. 2 is a similar diagram of another coincidence telemeter. Fig. 3 is a diagram of a symmetry telemeter. Fig. 4 is a diagram of another symmetry telemeter. Fig. 5 is a longitudinal vertical section through a coincidence telemeter, in which the optical arrangement shown in Fig. 2 is made use of.

In the example Fig. 1 two optical square prisms *a* are arranged in front of the objectives *b*. The separating prism composed of two prisms *c* and *d* cemented together deflects the two optical axes in their horizontal plane and combines them in the common focus of the objectives, which lies in the upper margin of the silver film (indicated by cross-hatching) serving as the separating surface. In this arrangement of the separating surface the under half of the inverted image projected from the right objective is combined, in the plane through the focal point at right angles to the combined axis, with the upper half of the inverted image projected by the left objective into an inverted total image. In measuring, the under partial image is moved in a horizontal direction, for which purpose a refracting prism *e* movable along the axis is provided. The combined axis emerging from the separating prism is deflected downward by a reflecting prism *f* and passes then through

the inverting lens *g*. The reflecting prism *h* provided with a ridge gives it finally the horizontal emerging direction, in which a Ramsden ocular consisting of the field lens *i* and the eye lens *k* is arranged. The sum total of all reflections through the prisms of the instrument has no image-erecting effect whatever. Since the erection by the inverting lens *g* extends to the total image composed of the two partial images, then in the hinder image field, which may coincide with the hinder surface of the prism *h*, the movable partial image originating from the right objective lies above.

The separating prism system *l m* of the second coincidence telemeter, Fig. 2, consummates the combination of the optical axes in a vertical plane. The common focal point, being also the combination point of the axes, lies in the lower edge of the separating surface, and this edge lies in the exit surface of the separating prism. The prism *m* is provided with a ridge, so that the two partial images correspond to one another in respect of right and left. The prism *n* in front of the ocular differs from the prism *h* in Fig. 1 not only by lacking a ridge, but also by its position, by virtue of which the emerging section of the optical axis remains in the vertical plane of the former sections. The observer sees in the upper half of the field of view the movable partial image coming from the right objective.

The symmetry telemeter Fig. 3 is provided with a separating prism *o p*, which combines the axes in the horizontal plane, the combined axis, however, being immediately deflected downward by a reflecting surface on the prism *p*, which corresponds to the reflecting surface of the prism *f* in Fig. 1. A simple reflecting prism *q* gives the axis then the horizontal direction of emergence. In the field of view of the observer the two partial images abut on one another in a vertical plane. The movable partial image produced by the right objective is situated on the left and is completely erected. The other partial image is, as is necessary for symmetry observation, inverted in the horizontal direction, because the pencil system passing through the left objective undergoes an uneven number of horizontal reflections.

In the second symmetry telemeter, Fig. 4, the separating prism *r s* has such a position, that the combination of the axes occurs in the vertical plane. The combined axis receives then, as in Fig. 2, the horizontal direction of emergence through a simple reflecting prism *n*. Also in this arrangement the observer sees the movable partial image projected by the right objective in the left half of the field of view, but this time the movable image is affected with the horizontal inversion.

As in the construction Fig. 5 the optical parts according to Fig. 2 are employed, this figure needs no further explanation.

The separating prisms shown and described belong to the same class. Separating prisms of any class may be substituted for them. Also instead of the inverting lens consisting of three parts cemented together a more composite inverting lens system may be employed.

I claim:

1. A horizontal separating prism telemeter with elevated entrance pupils, comprising two objectives reflecting prisms for suitably deflecting the optical axes individually, a separating prism system, an ocular, an inverting lens system arranged with vertical axis between the separating prism system and the occular, and means for moving one of the images projected by the objectives.

2. A horizontal separating prism telemeter with elevated entrance pupils, comprising two objectives, two optical square prisms, a separating prism system adapted to combine, in a vertical plane, the two optical axes proceeding from the objectives and the optical square prisms, an inverting lens system placed on the combined optical axis, a reflecting prism adapted to deflect the combined axis into a direction parallel to the base line, an ocular and means for moving one of the images projected by the objectives.

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Witnesses:

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