

926,061.

Patented June 22, 1909.

2 SHEETS—SHEET 1.

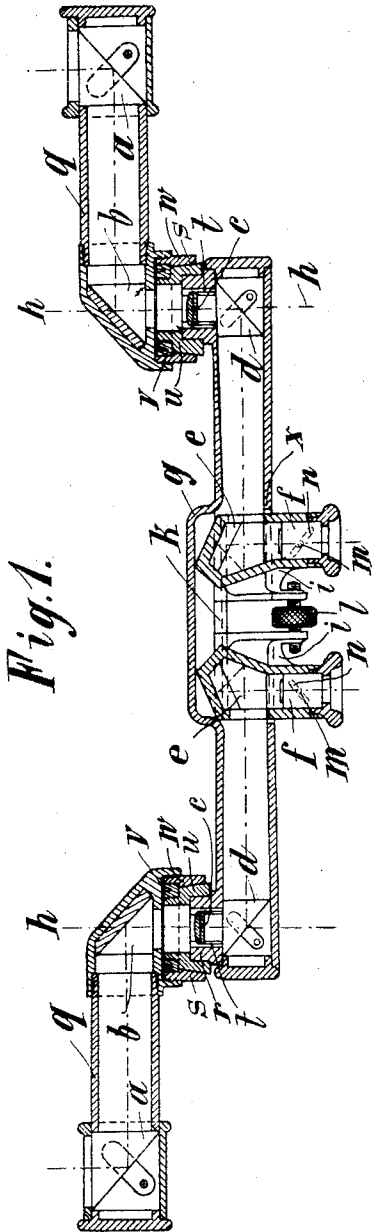
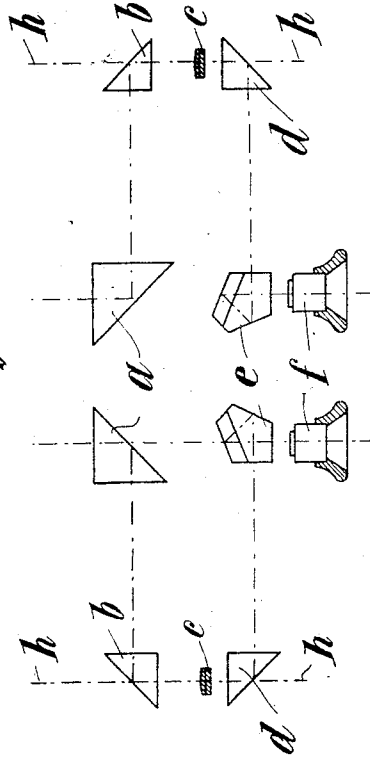


Fig. 1.

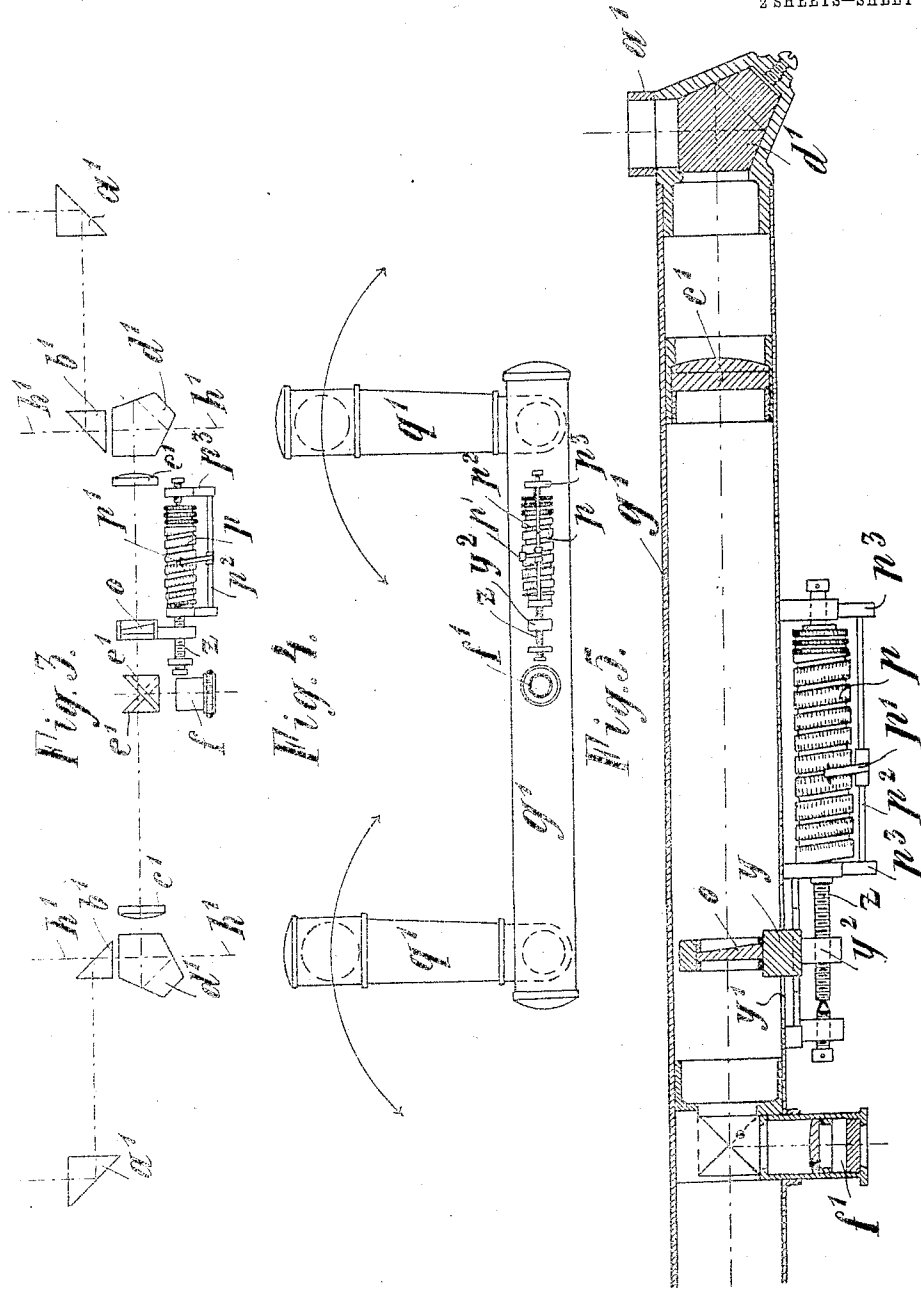
Fig. 2



Witnesses
E. C. Schuermann
[Signature]

Inventor
Adolf Hahn
by [Signature] & [Signature]
Attys.

926,061.



Witnesses:
E. C. Schumacher
[Signature]

Inventor:
Adolf Hahn.
by [Signature] Goldstern, Att'y.

UNITED STATES PATENT OFFICE.

ADOLF HAHN, OF CASSEL, GERMANY.

OPTICAL INSTRUMENT.

No. 930,981.

Specification of Letters Patent.

Patented June 22, 1909.

Application filed February 15, 1909. Serial No. 473,651.

To all whom it may concern:

Be it known that I, ADOLF HAHN, a subject of the Emperor of Germany, residing at Cassel, in the Empire of Germany, have invented certain new and useful Improvements in Optical Instruments, of which the following is a specification.

In the known optical instruments with two folding arms the division of the instrument into parts is effected purely mechanically, that is to say, without any regard to the optical arrangement of the instrument. In other words, in the folding arms of the instrument not only the deflecting means, but also other optical parts such as objectives etc. are disposed. The consequence of this is, that any wear of the pivotal connections between the folding arms and the rigid trunk of the instrument will necessarily reduce the exactitude and usefulness of the instrument.

My invention relates to an improvement in such optical instruments, whereby the exactitude of the instrument is rendered more independent of the wear of the pivotal connections than hitherto. The improvement consists in disposing the delicate optical parts, that is the lenses of the objectives, exclusively in the rigid trunk of the instrument, while the folding arms receive only deflecting means for receiving the rays of light and for sending them forward. The folding arms are adapted to turn around parallel axes at right angles to the axis of the trunk, the said axes being parallel to the axis of the eyepiece or eyepieces, so that for any position of any folding arm a ray of light emanating from the object and meeting the exterior deflecting means of the folding arm will be doubly deflected, after which it passes in a direction parallel to its original direction through the pivotal connection between the folding arm and the trunk. In consequence of this any wear of the said pivotal connection will have less influence upon the exactitude of the instrument than hitherto. The improved optical instrument with two folding arms may be a distance-meter or a binocular telescope according to there being one or two eyepieces.

I will now proceed to describe my invention with reference to the accompanying drawings, in which—

Figure 1 is a horizontal longitudinal section through an improved binocular telescope with two folding arms, which latter

are spread, Fig. 2 is a diagram of the same, the folding arms being folded, Fig. 3 is a diagram of an improved distance-meter with two folding arms, which latter are spread, Fig. 4 is an elevation of this distance-meter, the two folding arms being both turned upward into a vertical position, and Fig. 5 is a horizontal longitudinal section on an enlarged scale through the right half of the trunk of this distance-meter.

Similar letters of reference refer to similar parts throughout the several views.

The improved binocular telescope illustrated at Figs. 1 and 2 comprises a rigid tubular trunk *g* and two folding tubular arms *q q*, which latter are adapted to turn around parallel axes *h--h* at the ends of the trunk *g*. The manner in which the two folding arms *q q* are turnably connected with the trunk *g* is immaterial to my invention. For example the trunk *g* may be in one piece with two tubular connections *r r*, on which two sockets *u u* are in any known manner fastened. Each socket *u* has a conical surface *s* on which the corresponding inside of a socket *w* is adapted to turn. The socket *w* is shown as screwed into the folding arm *q*. In order to prevent the socket *w* from getting off the socket *u* a nut *v* is employed, which engages in the screw-thread on the reduced exterior portion of the socket *u* and bears against shoulders of both sockets *u* and *w*, as is clearly shown. Thus a substantial pivotal joint is formed between each folding arm *q* and the trunk *g*.

Each folding arm *q* is provided at the ends with two prisms *a* and *b*, which are secured in it in any known manner. The exterior prism *a* is to receive through an opening in the arm *q* the rays of light and to so deflect all the rays meeting it in a direction parallel to the axis *h--h* as to cause them to pass in the direction of the axis of the arm *q*, as is indicated by the dotted lines. The interior prism *b* is to receive these rays of light and to so deflect them as to cause them to pass in the direction of the axis *h--h* through the tubular connection *r*.

Into the openings of the two tubular connections *r r* two tubes *t t* are fitted in any known manner. Each tube *t* carries the lens *c* of the objective, which lens may be of any known construction. Through this lens *c* all the rays of light deflected by the interior prism *b* are obliged to pass.

At the ends of the trunk g two prisms $d\ d$ are fastened in any known manner. They are adapted to receive the rays of light passing through the lenses $c\ c$ and to so deflect them in opposite directions as to cause them to pass through the tubular trunk g toward the middle of the latter, as is indicated by the dotted lines.

The trunk g is provided with two preferably adjustable eyepieces $f\ f$. The manner in which the two eyepieces $f\ f$ are disposed in the trunk g and in which they are made adjustable, is immaterial to my invention. For example the trunk g is shown as provided with a longitudinal guide k on the rear side and with an opening x on the front side, in which two opposite frames $i\ i$ of any known construction are guided, while a regulating knob l with two oppositely threaded screws engaging in the frames $i\ i$ serves for simultaneously adjusting in a known manner the two frames $i\ i$ in the direction of the axis of the trunk g . The two eyepieces $f\ f$ proper are longitudinally guided in the two frames $i\ i$ in directions parallel to the two axes $h-h$, $h-h$. They engage each with two opposite pins m in slanting slots n provided in lugs (not shown) on the trunk g . It will be understood, that during the simultaneous adjustment of the two frames $i\ i$ in the direction of the axis of the trunk g also the two eyepieces $f\ f$ will be simultaneously adjusted in directions at right angles to the trunk g . However, the two eyepieces $f\ f$ and the two frames $i\ i$ may be of any other known construction and they may be arranged to be adjusted in any other known manner for obtaining sharp images, the only essential point being that the axes of the eyepieces $f\ f$ be parallel to the pivotal axes $h-h$, $h-h$ of the two folding arms $q\ q$. In each frame i a pentaprism e is shown as disposed in any known manner and this prism e is adapted to so deflect the rays of light emanating from the opposite prisms d as to cause them to pass through the eyepiece f , as is indicated by the dotted lines.

The two arms $q\ q$ can be both folded, as is indicated at Fig. 2, in which case the optical instrument will occupy the smallest space. They may be both spread, as is shown at Fig. 1, or they may be both turned upward into a vertical position, similar to Fig. 4, in which case it is for example possible for the observer to watch some object without being himself seen. For any position of the folding arms the rays of light meeting the exterior prisms $a\ a$ will pass through the pivotal joints $u\ w$ to the lenses c in directions parallel to their original directions. It is essential, that the delicate optical parts, that is to say, the lenses $c\ c$ of the objectives, be disposed in the rigid trunk g , while only deflecting means are provided

in the two folding arms. Then the exactitude of the optical instrument will be maintained for a longer time than hitherto.

The prisms $a\ a$ and $b\ b$ in the folding arms $q\ q$ may be replaced by equivalent deflecting means, such as plain mirrors or the like. Instead of in the openings of the tubular connections $r\ r$ the lenses $c\ c$ of the objectives may be disposed in the axis of the trunk g in a similar manner to that to be presently described with reference to Fig. 5. The prisms $d\ d$ and $e\ e$ may be severally replaced by other equivalent prisms.

Figs. 3 to 5 illustrate a distance-meter with two folding arms, the construction of which is substantially the same as that of the binocular telescope just described, only that a single eyepiece f^1 is employed, which is shown to be of another known construction. The parts of the distance-meter corresponding to those of the binocular telescope are denoted by the same letters of reference, only that they are primed. The two prisms $d^1\ d^1$ at the ends of the trunk g^1 are shown to be pentaprisms, while the two lenses $c^1\ c^1$ of the objectives are disposed in the axis of the trunk g^1 , as is shown in Fig. 5. The two pentaprisms $e\ e$ in the binocular telescope are here shown as replaced by two opposite prisms $e^1\ e^1$ having each only half their width and being so superposed, that their contact surface is in the central horizontal plane of the eyepiece f^1 . For measuring the distance of the object, the two halves of the image of which appear in the eyepiece f^1 , a known wedge-shaped prism o is provided in one (here the right) half of the trunk g^1 . This prism o is secured in a frame y , which is guided in a slot y^1 in the trunk g^1 and engages with its lug y^2 the screw-spindle z of a known measuring drum p . This drum p mounted to turn between two points shown is provided with a spiral groove, in which an indicator p^1 of any known construction is adapted to engage, while it is longitudinally movable on a rod p^2 secured in suitable lugs $p^3\ p^3$ on the trunk g^1 . As is well known, the drum p is so regulated by turning as to make the two halves of the image in the eyepiece f^1 coincide with one another. Then the distance of the object can be read off the scale on the drum p with the aid of the indicator p^1 . In this case the two folding arms $q^1\ q^1$ are assumed to be spread, as is shown at Fig. 3. If the distance-meter is to be used behind some cover, its two folding arms $q^1\ q^1$ are turned upward, as is shown at Fig. 4, so that they can just project above the cover, while the observer remains hidden. As in this case the base of the distance-meter, that is the distance of the two exterior deflecting means $a^1\ a^1$ is reduced, of course another scale provided on the drum p will require to be used.

The improvement according to my inven-

tion is particularly valuable for distance-meters, as thereby it is rendered possible to give the distance-meter a larger base without incurring the danger of considerable errors in reading off the distance of the object.

Either of the optical instruments described above can be varied in many respects without departing from the spirit of my invention.

10 I claim:

1. In an optical instrument, the combination of a trunk provided intermediate of its ends with sighting means, and arms swiveled to the ends of the trunk and foldable alongside and parallel with the latter, said arms receiving the rays of light at their outer or free ends.

2. In an optical instrument, the combination of a trunk provided intermediate of its ends with sighting means, and arms connected with the ends of said trunk and arranged to turn around axes located transversely of the trunk, the movement of the arms being in a plane parallel to the trunk.

3. In an optical instrument, the combination of a tubular trunk provided intermediate of its ends with sighting means, tubular arm connected with the ends of the trunk and movable in a plane parallel to said trunk, and means by which the rays of light which are received at the outer ends of said arms are transmitted to the sighting means.

4. In an optical instrument, the combination of a tubular trunk having sighting means intermediate of its ends and directed transversely of the trunk, tubular arms connected with the ends of the trunk and movable in a plane parallel with the latter, and deflecting means arranged in the arms and trunk.

5. In an optical instrument, the combination of a tubular trunk having sighting means, tubular arms connected with the ends of the trunk and movable about axes located transversely of the latter, said arms being open at their outer ends to receive rays of light passing in a direction transversely of the arms, and deflecting means arranged in the arms and trunk.

6. In an optical instrument, the combination of a tubular trunk having sighting means, tubular arms connected with the ends

of the trunk and movable about axes directed transversely of the trunk, said arms being foldable toward each other so as to lie alongside the trunk, deflecting means in the arms and in the trunk, and lenses in the trunk at opposite sides of the sighting means.

7. In an optical instrument, the combination with a tubular trunk having between its ends two eyepieces at right angles to its axis, of two folding tubular arms parallel to said tubular trunk and adapted to turn at the ends of the latter on one side around axes at right angles to its axis and parallel to said eyepieces, deflecting means in said two folding tubular arms adapted to receive rays of light in a direction parallel to said eyepieces and to send them first through the arms and afterward in the direction of their pivotal axes, and lenses and deflecting means disposed in said tubular trunk and adapted to receive the rays of light passing in the pivotal axes and to send them first through said trunk and afterward through said eyepieces.

8. In an optical instrument, the combination with a tubular trunk having between its ends two eyepieces at right angles to its axis, of two folding tubular arms parallel to said tubular trunk on the side opposite to said eyepieces and adapted to turn at the ends of said trunk around axes at right angles to its axis and parallel to said eyepieces, deflecting means in said two folding tubular arms adapted to receive rays of light in a direction parallel to said eyepieces and to send them first through the arms and afterward in the direction of their pivotal axes, and lenses and deflecting means disposed in said tubular trunk and adapted to receive the rays of light passing in the pivotal axes and to send them first through said trunk and afterward through said eyepieces.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ADOLF HAHN.

Witnesses:

WILHELM DOBLER,
HERMANN LÜTTEBRAND.