(Model.)

J. K. UNDERWOOD.

ASTIGMASCOPE.

No. 476,704. Patented June 7, 1892.

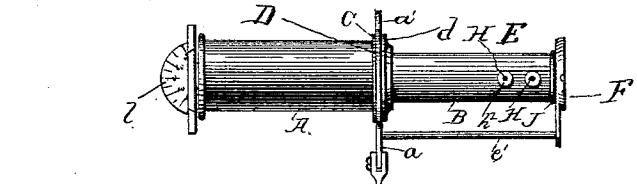


Fig. 1

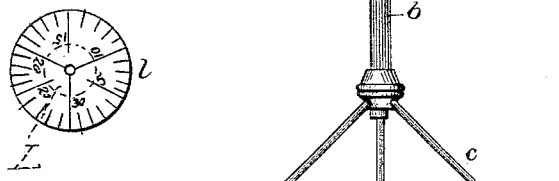


Fig. 12.

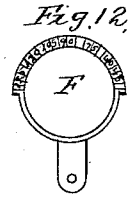


Fig. 13.

Fig. 2

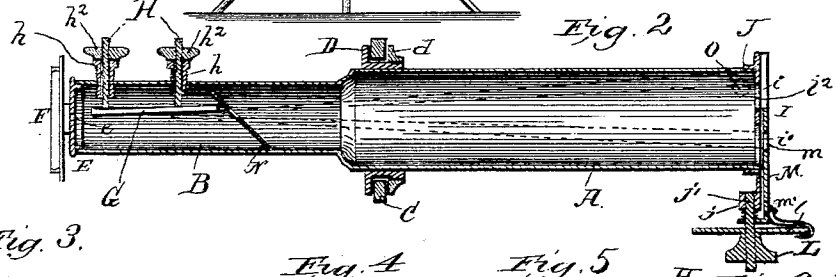


Fig. 3.

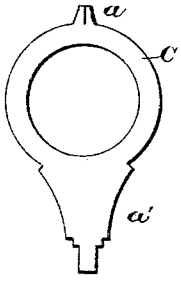


Fig. 4

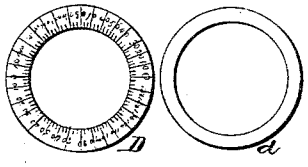


Fig. 5

Fig. 6

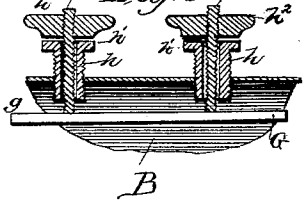


Fig. 7

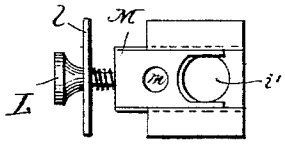


Fig. 8

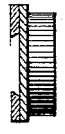


Fig. 9.

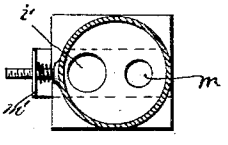


Fig. 10

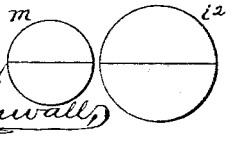
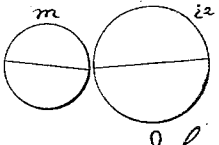


Fig. 11



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UNITED STATES PATENT OFFICE.

JOHN K. UNDERWOOD, OF GENEVA, NEW YORK.

ASTIGMASCOPE.

SPECIFICATION forming part of Letters Patent No. 476,704, dated June 7, 1892.

Application filed April 16, 1890. Serial No. 348,248. (Model.)

To all whom it may concern:

Be it known that I, JOHN K. UNDERWOOD, a citizen of the United States, residing at Geneva, in the county of Ontario and State of New York, have invented certain new and useful Improvements in Astigmascopes; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to instruments for detecting defects of the eye, such as astigmatism, myopia, omitropia, hypermitropia, &c. I prefer to and do call my apparatus an "astigmascope."

The invention consists in the novel construction and arrangement of parts, as will be hereinafter fully described, and defined in the claims.

The object of the invention is provide an instrument of such simple construction that it can be readily understood and operated without the least difficulty and at the same time produce results far superior to any other known instrument of its character.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of my astigmascope in position to be used. Fig. 2 is an enlarged longitudinal section thereof without its standard, showing the reflected image and the course of vision in dotted lines. Fig. 3 is an end view of my improved supporting-sleeve. Fig. 4 is a front view of my degree-circle and ring for attaching it to the barrel. Fig. 5 is a vertical section thereof. Fig. 6 is a detached sectional view of my mirror-holder and its adjusting-screws. Fig. 7 is an end view of a slide having a graduated disk. Fig. 8 is a top view of front plate of the apparatus. Fig. 9 is a rear view thereof. Figs. 10 and 11 show the semi-opaque glasses with lines drawn across their faces at proper angles. Fig. 12 is a detached front view of the lens-holder. Fig. 13 is a detached top view of the disk.

Like letters of reference denote like parts throughout the several figures.

An ordinary barrel A, having a smaller portion B, but preferably all in one piece, is supported in a sleeve C, having a lower projection a pivotally connected to the top of the standard b of a tripod c. Opposite the projection a on the sleeve C is a much shorter projection a', having on its front face the index-line, which acts as a finger or pointer for a ring D, having degrees or graduations on its face. This ring D is securely attached to the barrel A by an annular holder or keeper d and allows the said barrel to revolve freely in the sleeve C, at the same time carrying with it the graduated ring D.

In the front end E of the smaller portion of the barrel B is formed a hole e. Such end E is detachable and of ordinary construction. By a rod e', extending from the projection a to beyond said end E, is supported a lens-holder F, said holder having on its outer face graduating-marks corresponding to the graduations on the ring D, so that whatever degree is indicated on the ring D there will be the indication on the holder F; but it will be observed that the holder is entirely separate from the barrel A, while the ring D is securely attached to said barrel.

On the inside of the smaller portion B of the barrel A and in close proximity to the head E is suspended a mirror G, supported in a holder g, which is hung from the surface of the end B of the barrel A by two screw-threaded bolts H and H, securely attached at one end to the mirror-holder g and each surrounded by a sleeve or gland h, screw-threaded on its outside, so as to screw into a hole formed in the portion B of the barrel A. This gland has a suitable head h' and is provided with a lock-nut h^2, as clearly shown in Fig. 6. It will be observed that by means of these adjustable screws the mirror can be placed at any desired angle by screwing or unscrewing one or both of the glands, and then by tightening up the lock-nut the mirror is firmly fixed.

On the rear end of the barrel A is fitted a plate I, having a perforation i and a larger perforation i'. In the perforation i is fitted a semi-opaque glass i^2 or similar material. The barrel A is secured to and is arranged to turn with the flange J on the plate I, and said plate has a projection j, which forms the nut for a screw-threaded rod j', having a thumb

or other nut L, provided with a disk *l*, having the same graduating-mark on both sides.

M is a slide having in one end a small perforation, which is filled with a piece of semi-opaque glass *m*, while the other end has an extension *m'* at right angles to the slide M, such extension having a perforation of sufficient size to allow it to slide freely on the rod *j'*. By this arrangement of the above-described parts the glass *m* in the slide M can be raised or lowered by turning the thumb-screw L, and the disk *l* being rigid on said thumb-screw and having degree-markings on its face the distance traveled by the slide up or down will be indicated on said disk. The perforation *i'* being so much larger than the glass *m*, there is no difficulty experienced in not having the said glass register therewith, as clearly shown in Fig. 7.

The glasses i^2 and *m*, which are preferably of ground glass, have a black line drawn across their face. These glasses indicate the exact angle of greatest and least refraction in the eye—that is, when the lines of both glasses assume the position shown in Fig. 10 they indicate either no defect or the least refraction of the eye; but in all defective conditions of the eye the lines will deviate from each other, as shown in Fig. 11, because when the lines are seen as in Fig. 10 the eye is in perfect condition and not afflicted with astigmatism; but if not seen as in this figure, but as shown in Fig. 11, the eye is diseased to a greater or less degree, which will be indicated by the position of the glasses having the line across their face.

In the smaller portion of the barrel A and near the mirror is fixed a diaphragm N, having an opening about its center. Its function is to shut off from direct vision the glass i^2, and by means of the central opening in the said diaphragm the reflected image of the opening *i'* is seen, because if the image were not reflected it would always keep at one and the same position when the barrel is revolved; but the said image being reflected the position of such reflection must necessarily change as the barrel is revolved.

Having described particularly the different parts of my apparatus, I will now proceed to set forth its operation, which is as follows: The barrel A is placed in a horizontal position, as shown in Fig. 1, so that the zero-mark on the ring D registers with the index-mark on the sleeve C, and the zero-mark on the disk *l* registers with its index-finger. The instrument is now in condition to test the eye. Looking into the opening *e*, a view is had of the opening *i* by direct vision, and there will be seen at O a reflection of the glass i^2, because the diaphragm N shuts off from direct vision the small opening or glass *m*, and the said reflection O is seen only by means of the mirror, so that such image may come closer to or recede from the image had by direct vision. The barrel or tube A is turned in the sleeve C, carrying with it the graduated ring D. Should there be any error of refraction in the eye, the reflection O will approach to or recede from the opening *i*. Thus the point of greatest divergence is determined and indicated on the ring D. When the eye is in a perfect or normal condition, the line on each glass will be coincident with and continuations of each other, as shown in Fig. 10. Where any error of refraction exists in the eye, the lines will be seen more or less tangentially disposed with regard to each other, as shown in Fig. 11. This arises from the fact that one image is seen reflected inverted by the mirror, while the other image is viewed directly through the diaphragm and is not reflected or inverted. Therefore the apparent deviation or displacement of the line on each image is in opposite directions—that is, if the line on the large circle or image seen by direct vision should be inclined in one direction then the line on the reflected image or small circle would appear inclined in the opposite direction. The thumb-screw L is then turned until the disk *l* registers number or figure on the ring D. The figure thus indicated on the disk *l* will be the focus of lens required to correct the error. Should the error be simply myopia or hypermitropia the reflected image O will overlap the principal image *i* in the former defect and be separated from it in the latter case. Such overlapping and separation are indicated on the dial or ring D and the number of the correcting-lens is indicated on the disk *l*, which lens may be placed in the holder F and the barrel A again rotated to prove whether the operation has been correctly performed. If the glasses overlap equally at all points of rotation, myopia is present. Should they appear to be separated equally at all points hypermitropia is present, and may be measured as hereinafter stated.

By using an instrument as herein described great advantages are derived over the optometer, ophthalmoscope, and like instruments, for it has been found that in the use of the optometer it is very difficult and almost impossible to obtain anything like accurate results without paralyzing the celiary muscles of the eye, and in the ophthalmoscope it cannot indicate such results as my improved instrument, for it is only used to determine compound myopic astigmatism.

Having thus described the construction and operation of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an astigmascope, the revoluble barrel, the adjustable mirror suspended in the smaller portion of the barrel, and the diaphragm secured in the same portion of the barrel adjacent to and inclined from the mirror, with the glasses having a line across their face and located at the rear end of the said barrel, substantially as and for the purpose set forth.

2. In an astigmascope, the revoluble barrel, the adjustable mirror, the mirror-holder, and

the diaphragm having an inclined position relative to the mirror, in combination with the ring having graduated markings upon its face and securely attached to the said barrel, and the sleeve in which the barrel revolves, substantially as and for the purpose set forth.

3. In an astigmascope, the movable barrel having securely attached to it a ring having graduating markings on its face, in combination with a sleeve having a projection pivoted to a tripod or other standard and having opposite shorter projections provided with an indicator-line, said barrel being supported and revolved in said sleeve, carrying with it the graduated ring, substantially as shown and described, and for the purpose set forth.

4. In an astigmascope, the adjustable mirror, the centrally-perforated diaphragm located at the rear end of the mirror, and the mirror-holder, in combination with the barrel-supporting sleeve and the marking-ring, substantially as and for the purpose set forth.

5. The plate provided with openings *i* and *i'*, having a flange for the reception of one end of the tube or barrel A, in combination with the slide M, provided with a semi-opaque glass, substantially as shown and described, and for the purpose set forth.

6. The flanged plate having a projection in which is secured a screw-threaded rod and the slide M, having a perforated angle-piece through which the said rod passes, in combination with the disk having degree-markings thereon and the thumb-screw formed in the same piece with the disk, substantially as and for the purpose set forth.

7. In an astigmascope, the combination of the revoluble barrel comprising a large rear portion and a smaller front portion, of the slide adapted to be operated upon the face of the rear end of the large portion and the diaphragm secured in the said smaller portion between the mirror and the said large portion, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN K. UNDERWOOD.

Witnesses:
GEO. F. DITMARS,
THOS. R. GIBSON.