Nov. 8, 1927. 1,648,013

J. COPELAND

RETINOSCOPE

Filed Aug. 9, 1926 2 Sheets-Sheet 1

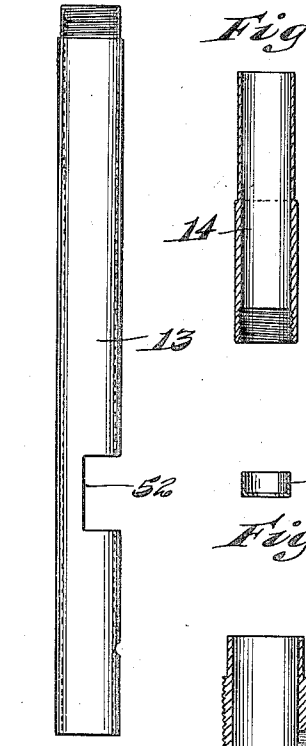


Fig. 5

Fig. 6

Fig. 4

Fig. 7

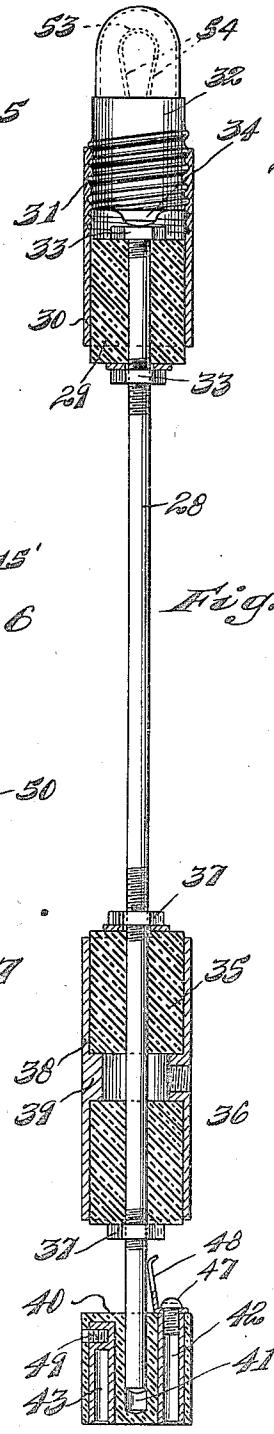


Fig. 2

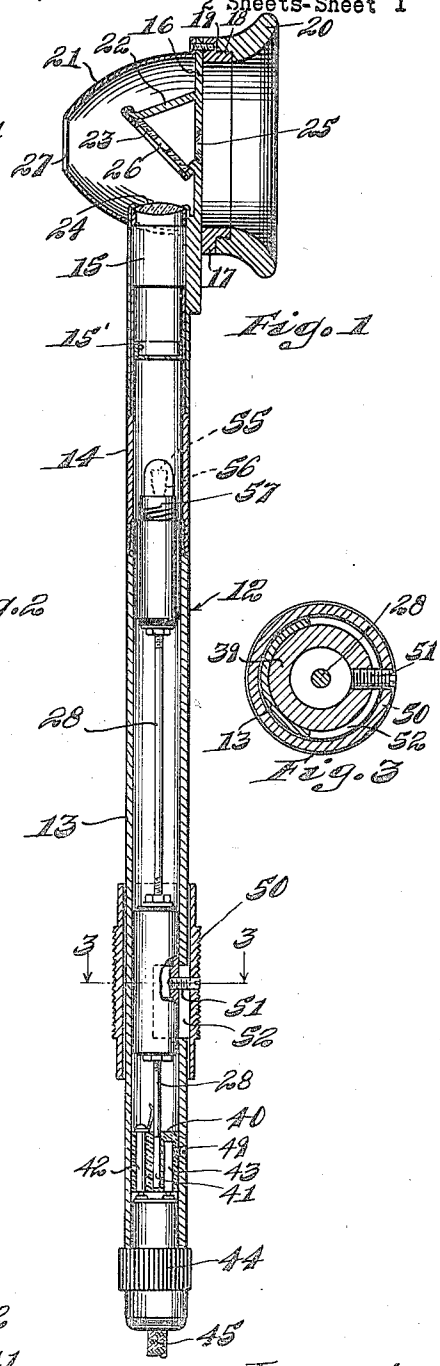


Fig. 1

Fig. 3

Witnesses:
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Fig. 8

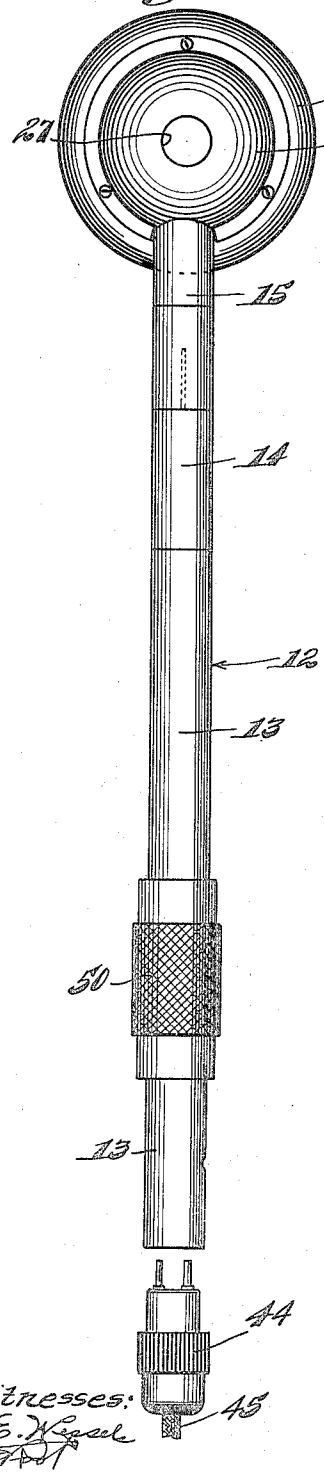
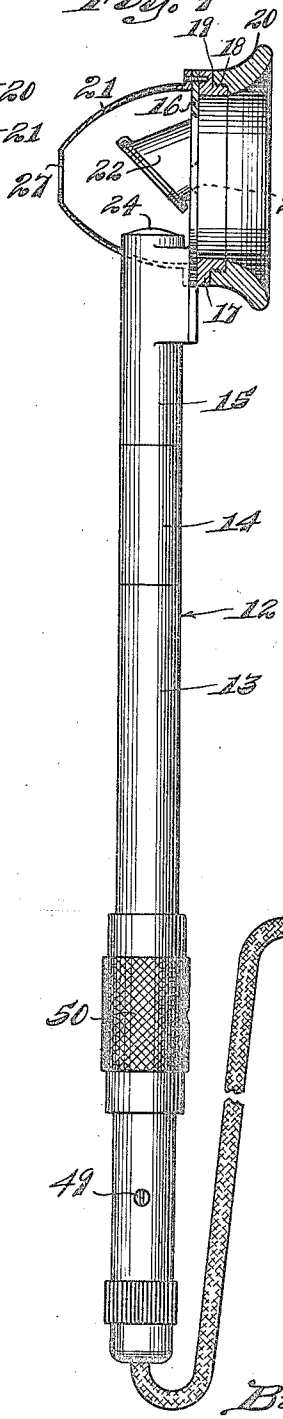
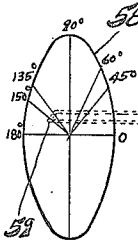


Fig. 9





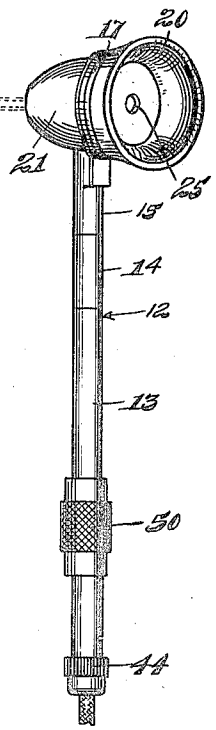
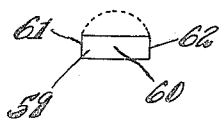


Fig. 10

Fig. 11



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Patented Nov. 8, 1927. 1,648,013

UNITED STATES PATENT OFFICE.

JACOB COPELAND, OF CHICAGO, ILLINOIS,

RETINOSCOPE.

Application filed August 9, 1926. Serial No. 128,020.

My present invention has reference to retinoscopy and has for its general object the provision of an improved retinoscope and method for examining eyes.

It is within the province of my invention to provide a self-luminous streak producing retinoscope through the agency of which to improve, modify and simplify the present system and technique of retinoscopy.

An outstanding object of my invention is the provision of means for producing a luminous streak of ribbon formation at right angles to any given meridian so as to enable the observer to concentrate and confine his attention and action to the particular meridian chosen for neutralization without interference of motion in any other meridian. The provision of the luminous ribbon makes possible a quicker and more accurate perception of the fundus reflex movements than can be had with the ordinary round field of light, and promotes greater accuracy in the neutralization of shadow movements. Moreover, by producing the luminous field in the form of a concentrated, well defined flat band which may be held at right angles to the meridians, the weaker and stronger meridians in astigmatism are clearly distinguishable so that the observer may readily determine the exact axis in astigmatism.

Another outstanding object of my invention is the provision of means for varying the width and distance of the luminous streak in order that the observer or operator may obtain greater accuracy in neutralization when examining patients affected with small pupils, large pupils, irregular astigmatism, dull media and high degrees of myopia or hyperopia and astigmatism.

Other objects will appear hereinafter.

The invention consists in the combinations and arrangements of parts hereinafter described and claimed.

The invention will be best understood by reference to the accompanying drawings, forming a part of this specification, and in which,

Fig. 1 represents a longitudinal section through a retinoscope made in accordance with my present invention;

Fig. 2 is a longitudinal section through the lamp carrying structure, this view being shown on an enlarged scale;

Fig. 3 is a cross section taken on the line 3—3 of Fig. 1;

Fig. 4 is a plan view of the lower part of the tubular handle;

Fig. 5 is a central section through the upper part of the tubular handle;

Fig. 6 is a section through the cup device arranged in the upper part of the handle;

Fig. 7 is a sectional view of the operating sleeve;

Fig. 8 is a rear elevational view of the improved retinoscope;

Fig. 9 is a side elevational view with the retinoscopic head shown in section;

Fig. 10 is a perspective view illustrating how the luminous streak of light may be held at right angles to the selected meridian; and,

Fig. 11 is a diagram on an enlarged scale of the luminous streak indicating in broken lines how, in turning, the center of the streak remains coincident with the center of revolution.

The preferred form of construction as illustrated in the accompanying drawings comprises a tubular handle 12 consisting of a lower part 13, an upper part 14 threaded thereon, and a neck part 15, which has tight frictional fit upon the upper end of the upper part 14. The neck part 15 carries at its upper end a telescopic head comprising an offset upwardly projecting center plate 16 on the front face of which is arranged a ring 17 having a flange 18 and a shoulder 19. A shield or annulus 20 is threaded upon the flange 18 and abuts the shoulder 19. Fitted against the rear face of the center plate 16 is a hood 21 within which is arranged a short tube 22 provided with the usual reflecting mirror 23. The tube 22 is attached to the center plate 16 and inclines downwardly therefrom as shown, and in such position as to be approximately at an angle of forty-five degrees with respect to the bi-convex lens 24 secured in the neck part 15 and through which the image or streak of light is projected onto the mirror 23 for reflection upon the eye. The center plate 16, reflecting mirror 23 and hood 21 are provided respectively with the alined sight openings 25, 26 and 27, the last mentioned opening 27 also serving as the opening through which the beam of light is reflected upon the eye.

Arranged within the tubular handle is a lamp carrying structure which is movable as an entity toward and away from the bi-convex lens 24 and which is also rotatable.

This lamp carrying structure preferably comprises a conducting rod or stem 28 provided at its top end with a non-conducting centering body 29 on which is fitted a conducting shell 30 threaded at 31 so as to comprise a socket for receiving and retaining the electric glow lamp 32. The centering body 29 is fixed on the rod by means of the upper and lower binding nuts 33 which are threaded upon said rod, the top binding nut being adapted to serve in an additional capacity in that it constitutes a terminal contact for the pole 34 of the glow lamp. 35 and 36 designate a pair of non-conducting centering bodies which are fixed upon the rod by means of upper and lower binding nuts 37 and a binding shell 38, there being an intermediate interior shoulder 39 formed on the binding shell to engage the confronting ends of the centering bodies whereby to hold them in fixed spaced-apart relation. Fixed to and within the lower part 13 of the tubular handle is a centering body 40 having an axial bore 41 in which the lower end of the rod has sliding and turning fit. This centering body 40 carries terminal sockets 42 and 43, for the reception of the terminal pins on the plug body 44 attached to one end of the circuit wires 45 which may be attached through the contacts 46 to any suitable rheostat or source of electricity. In the exemplification shown, there is secured upon the inner end of the terminal socket 42, by means of a binding screw 47, a conducting spring 48 which bears upon the conducting rod 28. The centering body 40 is made fast with the handle part 13 by passing a conducting screw 49 through said handle part and into the centering body 40 and terminal socket 43 therein.

In the construction shown, the means for rotating the lamp carrying structure and also for sliding the same, either toward or away from the bi-convex lens 24 consists in the provision of a knurled sleeve 50 which is movably mounted upon the handle part 13 and which is equipped with a screw pin 51 that extends through and works in a slot 52 in the handle part 13 and is threaded into shoulder 39 of the shell 38. By this arrangement, the glow lamp 32 may be moved either toward or away from the bi-convex lens 24 and it may also be rotated, the circumferential slot 52, in which the connecting pin 51 has movement, determining the extent of both the rotary and reciprocating movements of the glow lamp. In the present instance, the slot 52 has a circumferential extent sufficient to permit the glow lamp to be rotated through one hundred and eighty degrees while its longitudinal extent is sufficient to permit the focal length of the reflected beam to be varied to cause the rays thereof to be converged, diverged or brought to parallel, thus providing in a unitary structure a means for producing the effect and result of either a concave, convex or plano mirror retinoscope as are now employed in the art.

The current for causing the filament to glow in the lamp may be traced through the terminal socket 42, conducting spring 48, conducting rod 28, binding nut 33 at the top thereof, lamp terminal 34 to the filament, and thence back through the lamp base, shell 30, tubular part 13, screw 49 and terminal socket 43. It will be observed that through the sliding engagement of the rod 28 with the spring 48, the current is not interrupted at any time during the turning or reciprocation of the carrying structure and lamp. According to an important feature of my present invention, the glow lamp is provided with a filament in which the connecting top strand between the supporting legs will appear as a straight flat line in plan view. Thus, in Fig. 2, the filament top 53 is relatively long with respect to the spacing of the supporting legs 54 and it will be noted that if said filament top 53 be considered in plan it will have the appearance of a straight line substantially like the appearance of the straight top 55 connecting the supporting legs 56 of the glow lamp 57 shown in Fig. 1. Thus, in carrying out my invention I may employ a lamp having a filament like that shown in Fig. 2 or a lamp having a filament like that shown in Fig. 1 in order to obtain a luminous streak or beam of light. In use, the retinoscope is held before the patient in the usual way so that the flat ribbon like streak or beam of light emanating from the glow lamp will pass through the bi-convex lens and be reflected by the mirror out through the opening 27 and onto the eye to be examined, the operator making his observation through the sight openings 25 and 26 in the usual way. By referring to Fig. 10, where I have shown a chart 58 provided with lines designating the forty-fifth meridian, sixtieth meridian, ninetieth meridian, the one hundred and thirty-fifth meridian, etc., it will be seen that the projected streak of light 59 may be applied to any meridian selected and that by turning the sleeve 50 the luminous streak of light 59 may be held at right angles to the meridian selected. In this connection, it is to be observed from an inspection of Fig. 11 that in turning the glow lamp the center 60 of the streak of light remains coincident with the center of its rotation so that its extremities 61 and 62 describe the circumference of an imaginary circle. Since, under this situation it is unnecessary to turn the streak of light more than one hundred and eighty degrees in order to examine any desired meridian by turning the streak of light at right angles thereto, the circumferential extent of the slot 52 is preferably merely suf-

ficient to permit the operating sleeve 50 to be turned one hundred and eighty degrees.

Through the use of a flat ribbon like beam of light, instead of a round light as heretofore employed, the fundus reflex movements are much more readily perceived with the result that greater accuracy may be obtained in the neutralization of the shadow movements; and that the arrangement by which the streak of light may be held at right angles to the meridian to be neutralized, affords a positive and ideal method of confining the observer's attention and action to such meridian without interference of motion in other meridians. Moreover, through the employment of this method of examination, the weaker and stronger meridians in astigmatism are instantly and easily discernible so that the operator can readily and accurately determine the exact axis in astigmatism.

By moving the operating sleeve lengthwise of the handle, the cross sectional dimension of the luminous ribbon of light is varied, since by moving the operating sleeve the distance between the filament and the bi-convex lens is varied. As previously noted, the slot 52 determines the longitudinal movement of the glow lamp as well as the rotary movement thereof, and said slot is so provided that when the operating sleeve is at its highest terminal of movement the rays passing through the bi-convex lens will be divergent and produce a plano mirror effect. As the operating sleeve is moved downwardly the rays become convergent or focused along a line so that the ribbon of light 59 will be condensed and narrowed; and the longitudinal extent of said slot 52 is such that the glow lamp may be moved away from the bi-convex lens sufficiently to produce the effect of a concave mirror retinoscope. This provision for thus varying the character of the ribbon of light as it is held at right angles to the meridian to be neutralized is of great advantage to the operator in working with cases affected with small or large pupils, with irregular astigmatism, with dull media or with high degrees of myopia or hyperopia and astigmatism.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A retinoscope comprising in combination means providing a beam of light of ribbon formation, a reflector arranged in the path of said beam of ribbon formation, to reflect said beam into an eye and means for rotating the reflected portion of the beam into coincidence with the respective meridians of the eye.

2. A retinoscope comprising in combination, means providing an incident beam of light of ribbon formation, a reflector arranged in the path of said beam to reflect said beam, means for varying the cross-sectional dimension of said beams in the form of the beam of incidence, and means for rotating said beams of incidence and reflection in synchronism with each other.

3. A retinoscope comprising in combination, means providing an incident beam of light of ribbon formation, a reflector arranged in the path of said beam to reflect said beam in the form of the beam of incidence, and means for rotating said beams of incidence and reflection relatively to said reflector.

4. A retinoscope comprising in combination, means providing an incident beam of light of ribbon formation, a reflector arranged in the path of said beam to reflect said beam, means for varying the cross-sectional dimension of said beams in the form of the beam of incidence, and means for rotating said beams of incidence and reflection relatively to said reflector in synchronism with each other.

5. A retinoscope comprising in combination, means providing an incident beam of light of ribbon formation, a stationary reflector arranged in the path of said beam to reflect said beam in the form of the beam of incidence; and means for rotating same beams of incidence and reflection in synchronism with each other.

6. A retinoscope comprising in combination, means providing an incident beam of light of ribbon formation, means for rotating said first mentioned means, a reflector arranged in the path of said beam to reflect said beam of incidence, said reflected beam being rotatable upon rotation of said first mentioned means.

7. A retinoscope comprising in combination, means providing an incident and reflected beam of light of ribbon formation, and means for rotating said beam of incidence and reflection upon axes arranged at an angle to each other.

8. A retinoscope comprising in combination, means providing an incident and reflected beam of light of ribbon formation, means for rotating said beam of incidence and reflection upon axes arranged at an angle to each other and means for converging and diverging the rays of the reflected beam.

9. A retinoscope comprising in combination, means providing a beam of light of

ribbon formation, and means for rotating said beam through an arc of substantially 180 degrees.

10. A retinoscope comprising in combination, means providing a beam of light of ribbon formation, means for reflecting said beam, a sight arranged axially of the reflected portion of said beam, and means for rotating said beam of incidence relatively to the reflector and thereby causing said beams to rotate in synchronism with each other upon their respective axes.

11. A retinoscope comprising in combination, means providing a beam of light of ribbon formation, means for reflecting said beam, a sight whereby the reflected portion of said beam may be viewed through said reflector, and means for causing the rotation of said incident and reflected beams in synchronism with each other upon their respective axes.

12. A retinoscope comprising in combination, means providing an incident beam of light of ribbon formation, means for reflecting said beam, and means for rotating said reflected beam upon the axes thereof.

13. A retinoscope comprising in combination, a tube, means including a lamp for providing a beam of light of ribbon formation, means whereby said beam may be rotated, means for moving said first mentioned means longitudinally of said tube, and a reflector arranged at one end of said tube to reflect the beam in said ribbon formation.

14. A retinoscope comprising in combination, means for casting a beam of light of ribbon formation into an eye and means for rotating said beam to a position corresponding to the respective meridians of the eye.

15. In a retinoscope the combination of a tubular member, means carried by the tubular member for producing a beam of light of ribbon formation, a hood secured to the tubular member, a reflector located in the hood, said reflector being located in the path of the beam of light of ribbon formation to reflect said beam, aligned sights respectively provided in the reflector and in said hood and means for rotating the reflected beam into coincidence with the respective meridians of the eye.

16. In a retinoscope the combination of a tubular member, means carried by the tubular member for producing a beam of light of ribbon formation, a hood secured to the tubular member, a reflector located in the hood, said reflector being located in the path of the beam of light of ribbon formation to reflect said beam, aligned sights respectively provided in the hood and reflector, means for rotating the reflected beam into coincidence with the respective meridians of the eye and means for varying the dimension of the reflected portion of said beam.

17. In a retinoscope the combination of a tubular member, means carried by the tubular member for producing a beam of light of ribbon formation, a hood secured to said tubular member, a reflector located in said hood, said reflector being located in the path of the beam of light to reflect said beam, aligned sights respectively provided in the hood and reflector, means for rotating the reflected beam into coincidence with the respective meridians of the eye, said first mentioned means being movable longitudinally of the tubular member to thereby vary the dimension of the reflected portion of said beam.

18. In a retinoscope the combination of a lamp having a filament whereby a beam of light of ribbon formation results upon illumination of said lamp, a reflector located in the path of said beam of ribbon formation to reflect said beam, said lamp being mounted for movement toward and away from the reflector and being rotatable to thereby cause rotation of the reflected portion of the beam into coincidence with the respective meridians of an eye.

In testimony whereof I have signed my name to this specification.

JACOB COPELAND.