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2,501,438

STREAK RETINOSCOPE

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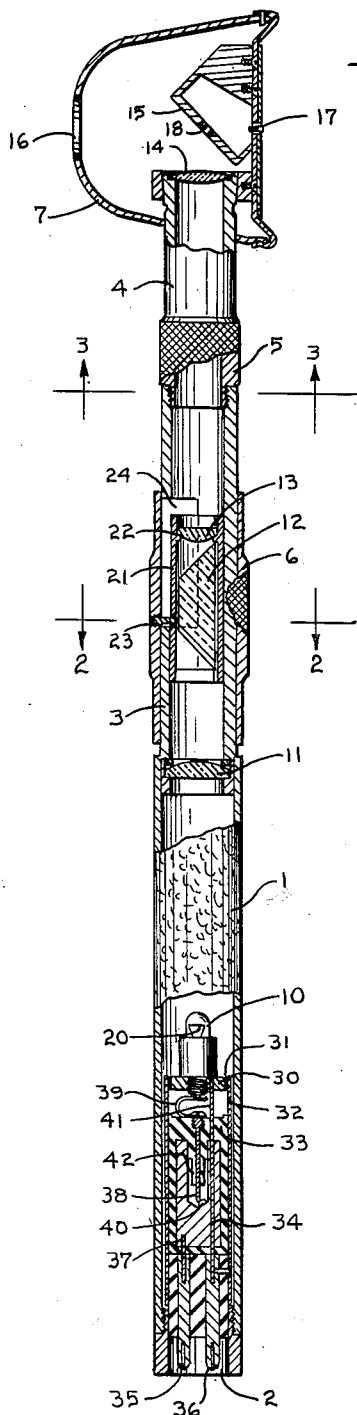


FIG. 1

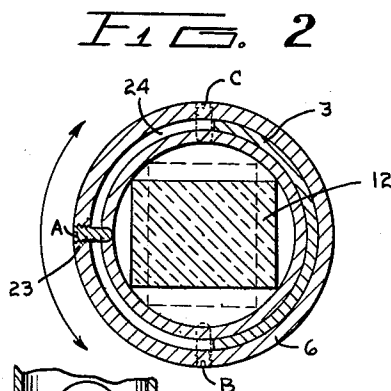


FIG. 2

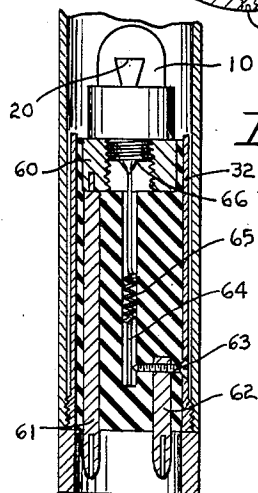


FIG. 4

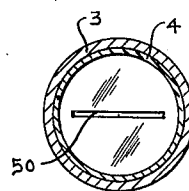
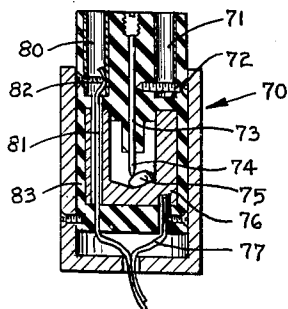


FIG. 3



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STREAK RETINOSCOPE

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8 Claims. (Cl. 88—20)

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This invention relates to a retinoscope, particularly a streak retinoscope.

A streak retinoscope has several differences when compared with other retinoscopes. For example, the projected light is a linear band instead of circular and the band or streak is variable in width. A second difference is that the streak retinoscope scans and neutralizes the pupillary reflex along any individual meridian of the eye independently from all other meridians.

To obtain the full advantages of a streak retinoscope it is, therefore, necessary to provide means for rotating the streak and to provide means for adjusting the width of the streak. To obtain a linear form of light in the retinoscope such as a streak a specially constructed light bulb is used which incorporates a straight filament so that the streak of light which is projected into the eye is an exact image of the filament in the bulb. In order to rotate the streak it has ordinarily been necessary to provide some means for rotating the lamp bulb. It is also necessary to provide some means for varying the width of the streak. This has ordinarily been done by providing an optical system and by providing for longitudinal movement of the lamp bulb so that the width of the streak would depend upon the relative position of the bulb with respect to the distance from the optical system.

The old method of rotating the bulb so that the streak can then be rotated is to provide some means between the bulb and the electrical connection such as, for example, sliding contacts (see my Patents Nos. 1,648,013 and 1,804,151) or an accumulation of wires of a length sufficient to provide for twisting. The old method of providing for longitudinal movement of the bulb for changing the width of the streak of light also requires an accumulation of wires or some kind of sliding contact between the light bulb and the source of electric current. Sliding contacts are never entirely satisfactory. When twisted wires are placed between the plug and the light bulb, constant use of the instrument will be wearing upon the wires and there is likelihood of a short circuit or clear break in the wire connections.

According to the present invention it has been found possible to construct a streak retinoscope in which the streak can be rotated and in which the width of the streak can be adjusted while at the same time securing the advantages of a non-rotating bulb in fixed position. This is accomplished by providing a spheroprismatic

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optical system which rotates the image and which varies the width of the streak.

With a fixed bulb it has also been found advantageous to employ an inclination responding switch which automatically causes the bulb to light when the instrument is raised to an erect position and automatically turns off the light when the instrument is placed in a horizontal position.

In the old type streak retinoscope it has also been customary to provide a sleeve attached to the bulb carrying device to rotate the bulb which produces the streak of light. A slot is provided in the tubular container to permit rotation of the sleeve. In order to not unnecessarily weaken the tubular container, the slot was not cut more than 180° so that the amount of rotation that could be given to the bulb (and, therefore, the streak of light) was limited to 180° in the previous type of streak retinoscopes. By employing an optical rotating device, such as a Dove prism, which rotates the image two degrees for every degree of rotation of the optical system, the present invention provides for a rotation of the image the full 360° by employing a slot of only 180° in the tubular container. Although there are only 180 meridians in a complete 360° circle, in rotating the streak through these 180° meridians, one finds the 180° limiting factors effected by the slot to be a source of considerable annoyance. When one requires only a few degrees of movement of the streak in a given quadrant and finds that this movement is limited by the slot, a backward rotation in excess of 90° is necessitated in order to observe the desired meridian. If, for example, the streak were located at meridian 180 (horizontal position) and could not rotate clockwise one must then rotate counter clockwise through 170° to reach a desired meridian of 170°. In the present retinoscope one need only to rotate the streak 10° (or the optical system 5°) to obtain the 170° meridian.

An object of this invention is to construct a streak retinoscope in which it is not necessary to rotate or move longitudinally any of the electrically connected parts to obtain a rotation of the streak or to obtain a variation in the width of the streak.

Another object of the invention is to construct a streak retinoscope with an automatically operated electrical switch which will automatically extinguish or turn off the light bulb when the instrument is placed in a horizontal position. Usually the light bulbs employed in a streak

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retinoscope are specially constructed bulbs with a straight line filament and for this reason they are expensive. It is, therefore, important not to keep the bulbs lighted when they are not in use.

The novel features characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal section through a retinoscope made according to this invention.

Figure 2 is a cross-sectional view taken along line 2—2 of Figure 1.

Figure 3 is a view taken on line 3—3 of Figure 1 and showing an image of the streak.

Figure 4 is a longitudinal sectional view of the base of a retinoscope and a plug therefor.

Generally, the retinoscope comprises a handle portion 1 containing at its lower end a plug 2. Connected to the handle portion are two tubular portions 3 and 4 which are attached to each other in some way, as shown at 5. Surrounding the lower tubular portion 3 is a sleeve 6 which holds part of the optical system. Affixed to the top of the sleeve 4 by friction or by other means is the reflecting cap portion 7.

The optical system of the device (in the order in which the light passes through the instrument) comprises a lamp 10 which is specially constructed with a straight filament 20, a positive lens 11, a Dove prism 12, a second lens 13 which is shown in the drawing as a positive lens but which may be a negative lens, the lens 14 which is another positive lens and the reflecting mirror 15. Lamp bulbs with other types of planar filaments may be employed although a straight line filament is preferred because at present it is the easiest of the planar filaments to construct. By a "planar filament" is meant a filament which lies in a single plane which is perpendicular to the direction the light is passed through the tube.

In the cap portion 7 there is a series of aligned orifices 16, 17 and 18. The orifice 16 is in the portion of the cap which is directed toward the patient's eye. The orifice 17 is directed toward the observer's eye and the orifice 18 is in the silver mirror 15. The orifice 18 is shown as a hole in the mirror. However, it is possible to just omit the silvering from the portion in the mirror.

The Dove prism of the optical system is held in a sleeve 21. The lens 13 is also held in the sleeve 21 by means of a circular indentation 22. The sleeve 21 is held in position within the tubular portion 3 by a set screw 23 which connects it to the sleeve 6. A portion of the tubular portion 3 is cut away as shown at 24 in Figures 1 and 2 so that the sleeve 22 containing the Dove prism and the lens 13 may be rotated about 180° and moved longitudinally. A Dove prism is a trapezoidal shaped prism and it has the property of rotating a beam of light. For every degree of rotation of the prism a beam of light which enters one end of the Dove prism is rotated two degrees so that by providing for 180° of rotation in the sleeve 21 the beam of light which comes from the filament 20 can be rotated 360°.

The lens 11 is a collimating lens and serves to make parallel the rays which come from the filament 20 of the lens 10. After passing through

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the Dove prism the parallel rays pass through the positive lens 13 and form an image of the filament 20 at some point between the said lens 13 and the lens 14. If a screen were placed at line 3—3 of Figure 1 the image projected thereon would be as indicated at 50 of Figure 3. If this image is formed at a distance from 14 which is equal to the focal length of the lens 14 the rays which emerge from the lens 14 will be parallel. The lens 13 can be moved with the Dove prism and depending on the position of the said lens 13 the image of the filament may fall either at the focal point of lens 14, in front of the focal point of the lens 14, or in back of the focal point of the lens 14. When the sleeve 21 and lens 13 are at their lowest point, that is when they project an image of the filament back of the focal point of lens 14, the effect of the resultant rays is the same as that produced by a concave mirror retinoscope, i. e., the rays leaving the retinoscope are sufficiently convergent to be focused or crossed in front of the patient's eye.

An example of one type of optical system would be a positive lens having a focal length of 25 mm. at 11, a positive lens having a focal length of 19 mm. at 13; and a positive lens having a focal length of 50 mm. at 14. By employing a lens at 13 which has a shorter focal length than the lens employed at 11, a filament image of reduced size is produced between the lens 13 and the lens 14. Since it is not practical to reduce the size of the filament 20 in the bulbs 10 too much, this is very advantageous.

An inclination responding switch which is particularly adapted for use with this instrument is shown in Figure 1. This comprises two brass plugs 35 and 36 and a brass lamp socket 30 which are all set in a steel or brass tubular container 32. The brass lamp socket is insulated from the tubular container 32 by a suitable insulating material such as a phenol formaldehyde condensation product, shown at 31. Similar insulating material 33 is also employed to insulate the steel or brass tube 32, and so forth, from the mercury contact elements. The mercury contact elements comprise a cup-like portion 34 made from stainless steel and a stainless steel pin 38 reaching into the cup portion. Materials inert to arcing and inert to amalgamating with mercury, such as stainless steel, must be used as the contact elements.

The plug element 35 is connected to the stainless steel contact element 34 by means of a connector 37. The lower end of the bulb 10 is connected to the pin connector 38 by means of a spring device 39. The second connection from the bulb to the other plug 36 is made by an insulated wire 41 which is shown as passing from the outside of the bulb 10 through the insulating material and the stainless steel to the plug 36. A drop of mercury, by which the electrical connection between the pin or connector 38 and the stainless steel cup 34 is made, is shown at 40. When the instrument is held upright as shown at 1 the drop of mercury falls by gravity so as to connect the pin 38 and the stainless steel cup 34 and lighting the bulb. When the instrument is placed in a horizontal position the mercury drops back along the side wall of the cup thereby breaking the connection. The insulating material extends downward over the pin 38 as shown at 42 to prevent contact of the mercury with the pin 38 when the instrument is in a horizontal position or when the instrument is turned downward. To connect the retinoscope to a source of

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electricity a suitable female plug is attached to the prongs 35 and 36. If desired a mercury switch of the type shown above the plugs 35 and 36 may be external to the tubular assembly and located within the female plug which is to be attached to the plugs 35 and 36 making this new feature available to the older type of instrument.

The modification referred to in the previous paragraph is shown in Figure 4 of the drawing. In this modification the lamp bulb 10 is screwed into the brass socket 60 and one side of the bulb is connected to the plug 61 through the brass socket 60. The other plug 62 is connected by screw 63 to the center conductor 64, which includes a spring portion 65, to the center contact 66 of the lamp bulb. The inclination responsive switch is included in the female plug member 70. The orifice 71 of the female plug 70 is connected by screw 72 to the center conductor 73 having the pin connector 74 at its lower end. A drop of mercury 75 is contained in the stainless steel cup member 76 which is electrically connected to the lead in wire 77. The other female plug orifice 80 is connected to the other lead in wire 81 by screw 82 which is insulated from steel cup 76. The structure is all set in insulating material 83.

It will be seen that there has been provided a new and novel streak retinoscope which has all the advantages of the streak retinoscopes now employed and which also has the advantages of not requiring any twisted or longitudinal movement of the electrical connections between the lamp bulb and the connecting plug and any rotation or movement of the lamp bulb itself. It also has the advantage of providing for the rotation of the streak the full 360° instead of the usual 180°. The device of the present invention also provides for automatically turning off the light bulb when the instrument is placed at rest in a horizontal position.

Although certain specific embodiments of this invention have been shown and described, it will be understood that many modifications thereof are possible. This invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim:

1. In a retinoscope, the combination comprising a tubular housing, a relatively fixed lamp bulb socket adjacent one end of said housing, a lamp bulb in said socket, a first lens means for collimating the light from a bulb held in said socket, a Dove prism with one end thereof located adjacent said lens, a second lens located adjacent the other end of said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing.

2. In a retinoscope, the combination comprising a tubular housing, a relatively fixed lamp bulb socket adjacent one end of said housing, a lamp bulb in said socket, a first lens means for collimating the light from a bulb held in said socket, a Dove prism located adjacent said lens, a second lens located adjacent said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal

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movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing, a third lens located adjacent the end of the tubular housing opposite to the lamp socket adapted to project an image whereby the rays projected from said third lens may be made parallel, convergent or divergent depending upon the longitudinal position of the sleeve and the second lens.

3. In a retinoscope, the combination comprising a tubular housing, a relatively fixed lamp bulb socket adjacent one end of said housing, a lamp bulb in said socket having a geometrically shaped planar filament, a first lens means for collimating the light from a bulb held in said socket, a Dove prism located adjacent said lens, a second lens located adjacent said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing, a third lens located adjacent the end of the tubular housing opposite to the lamp socket adapted to project an image whereby the rays projected from said third lens may be made parallel, convergent or divergent depending upon the longitudinal position of the sleeve and the second lens.

4. In a streak retinoscope, the combination comprising a tubular housing, a relatively fixed lamp bulb socket adjacent one end of said housing, a linear filament lamp bulb in said socket, a first lens means for collimating the light from a bulb held in said socket, a Dove prism located adjacent said lens, a second lens located adjacent said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing, a third lens located adjacent the end of the tubular housing opposite to the lamp socket adapted to project an image whereby the rays projected from said third lens may be made parallel, convergent or divergent depending upon the longitudinal position of the sleeve and the second lens.

5. In a retinoscope, the combination comprising a tubular housing, means for producing a planar figure of light adjacent one end of said housing, a first lens means for collimating the light from the light producing means, a Dove prism with one end thereof located adjacent said lens, a second lens located adjacent the other end of said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing.

6. In a streak retinoscope, the combination comprising a tubular housing, a relatively fixed lamp bulb socket adjacent one end of said housing, a lamp bulb having a linear filament in said socket, a first lens means for collimating the light from a bulb held in said socket, a Dove prism located adjacent said lens, a second lens located adjacent said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing, a third lens located adjacent the end of the tubular housing opposite to the lamp socket adapted to project an image whereby the rays projected from said third lens may be made parallel, convergent, or divergent depending upon the longitudinal position of the sleeve and the second lens, two terminal elements for connecting said bulb socket with a source of electric current, one of said terminal elements being connected directly to a contact for one electrode of said bulb, a mercury switch comprising a cup-like element of stainless steel, a prong-like element extending into said cup, and a drop of mercury within the cup-like element adapted to contact the prong-like element when the tubular housing and bulb is held upright to connect the second terminal element to the other electrode of said bulb, the lamp socket and the mercury switch being held in a single sealed unit detachably connected to the end of the tubular housing.

7. In a retinoscope, the combination comprising a tubular housing, means for producing a planar figure of light substantially perpendicular to the axis of and adjacent one end of said tubular housing, a first lens means for collimating the light from a said planar figure of light, a Dove prism located adjacent said lens, a second lens located adjacent said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated

and moved longitudinally with respect to said housing, a third lens located adjacent the end of the tubular housing opposite to the means for producing the planar figure of light adapted to project an image whereby the rays projected from said third lens may be made parallel, convergent or divergent depending upon the longitudinal position of the sleeve and the second lens in said housing.

8. In a retinoscope, the combination comprising a housing, means for producing a linear line of light substantially perpendicular to the axis of and adjacent one end of said tubular housing, a first lens means for collimating the light from said line of light, a Dove prism located adjacent said lens, a second lens located adjacent said Dove prism, a slot in said housing, a holder for said Dove prism and said second lens located within said housing, a sleeve mounted for rotation and for longitudinal movement about the outside of said housing, means passing through the slot in the housing and attached to the sleeve and the holder for the Dove prism whereby the Dove prism and the second lens may be rotated and moved longitudinally with respect to said housing, a third lens located adjacent the end of the tubular housing opposite to the means for producing the linear line of light adapted to project an image whereby the rays projected from said third lens may be made parallel, convergent or divergent depending upon the longitudinal position of the sleeve and the second lens in said housing.

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