No. 785,439. PATENTED MAR. 21, 1905.

H. L. SAYEN.

PERIMETER.

APPLICATION FILED FEB. 1, 1902. RENEWED NOV. 10, 1904.

3 SHEETS—SHEET 1.

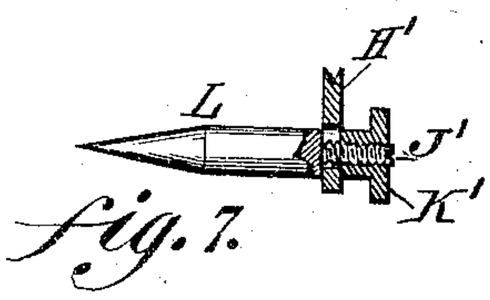


fig. 7.

fig. 1.

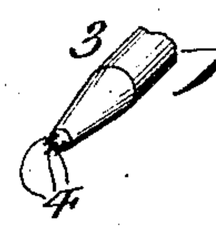


fig. 8.

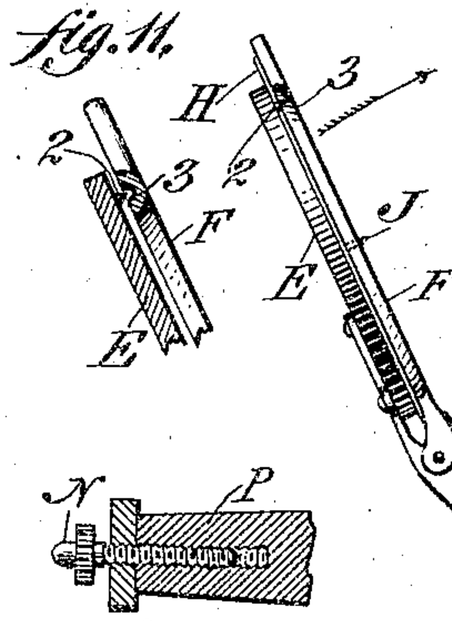
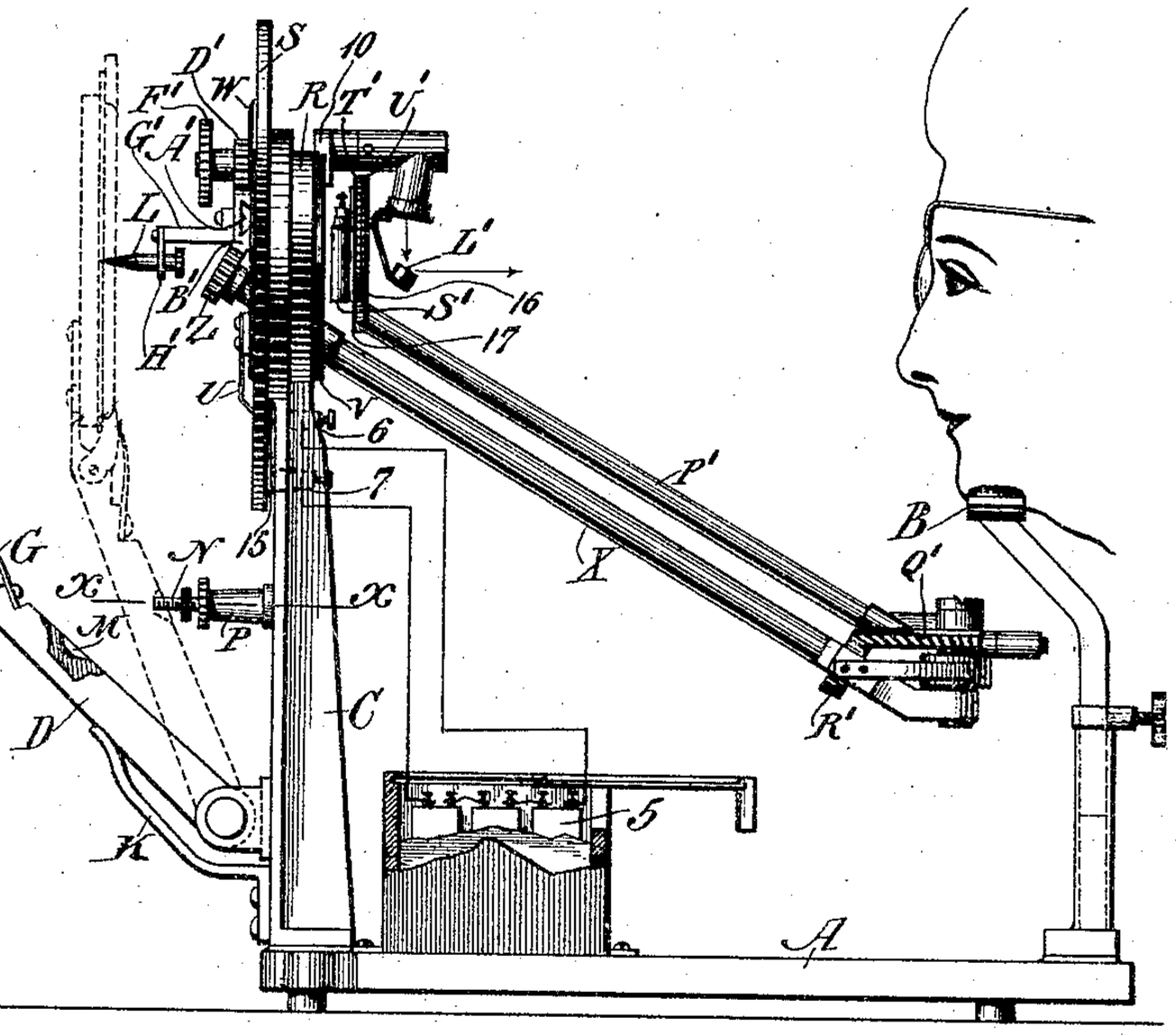


fig. 11.

fig. 6.



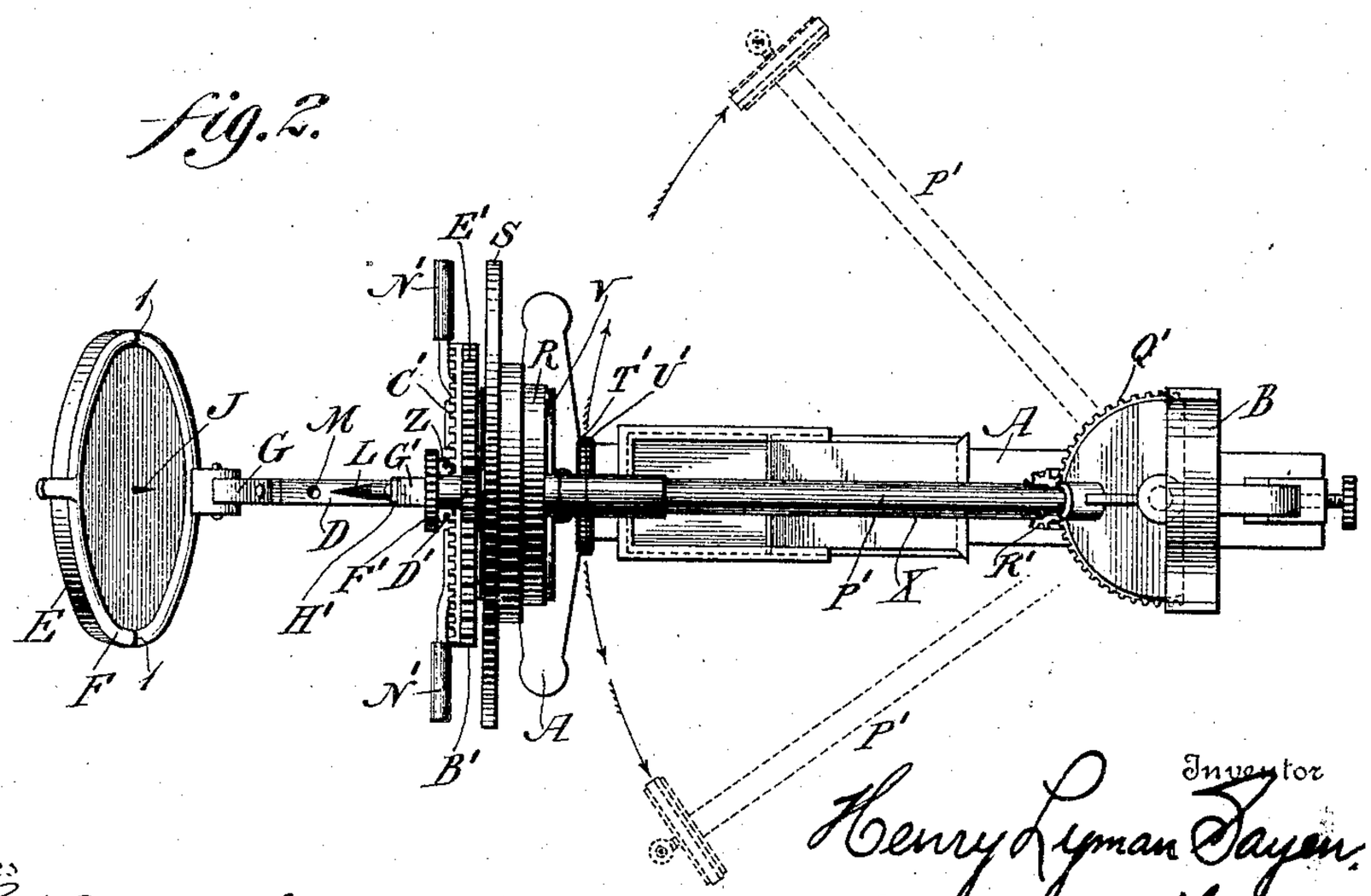


fig. 2.

Witnesses
L. Bouville,
P. J. Sagles.

Inventor
Henry Lyman Sayen.
Wiedenbeim & Fairbanks.
Attorneys

By

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3 SHEETS—SHEET 2.

fig. 3.

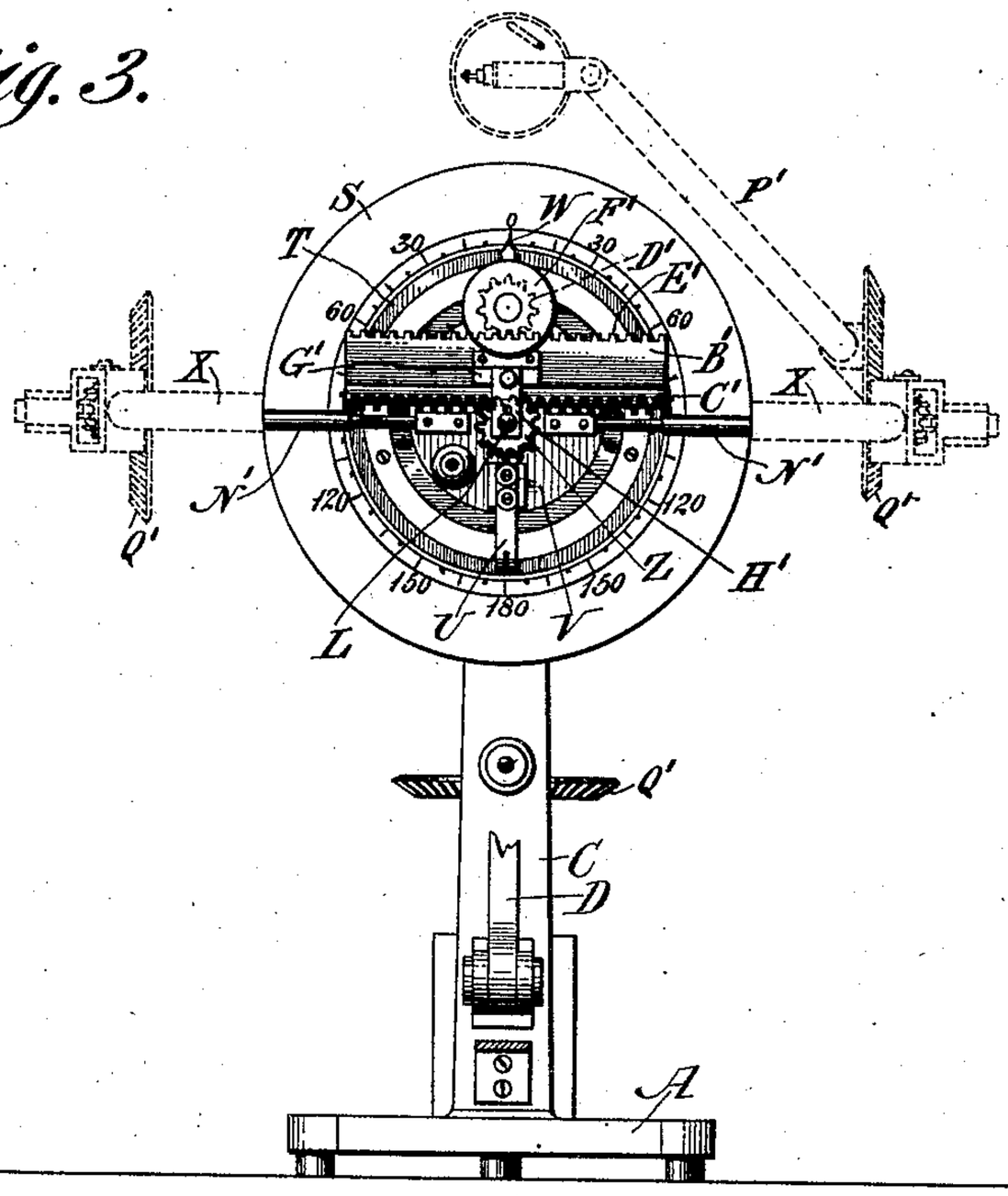


fig. 4.

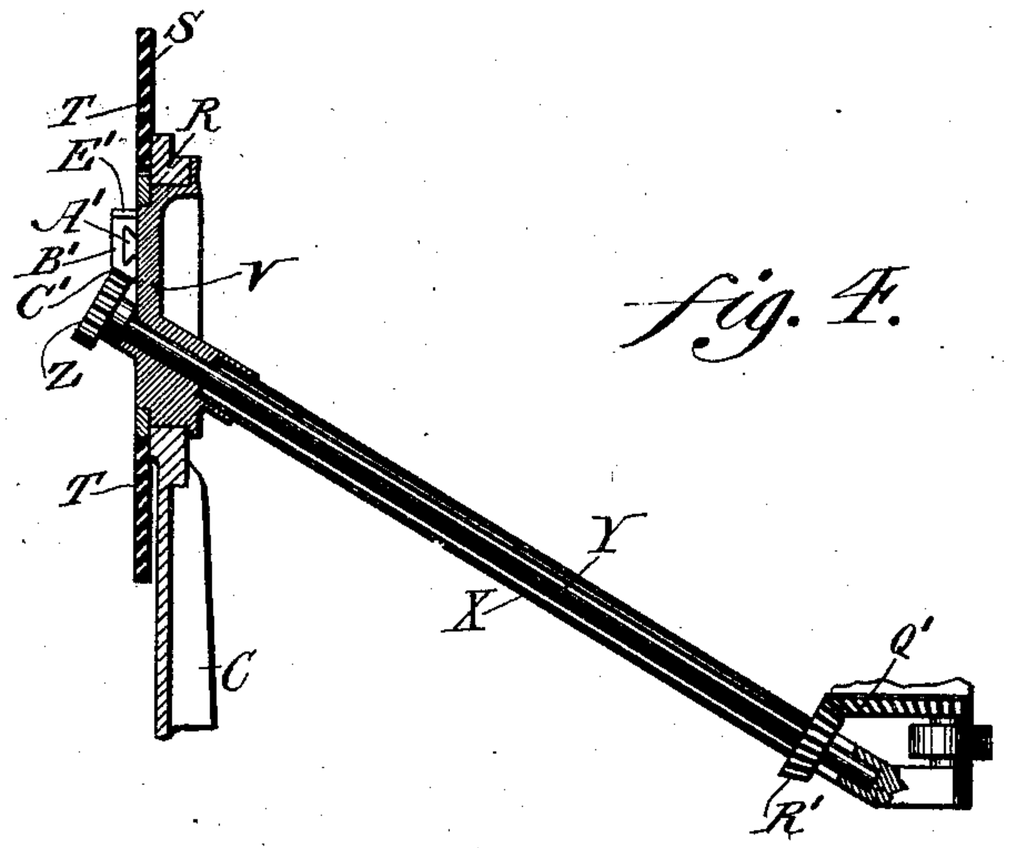
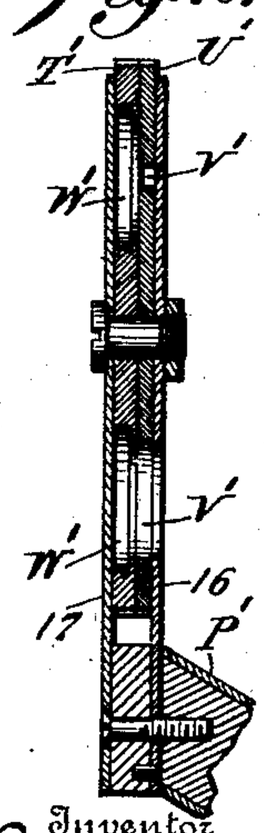


fig. 10.



Witnesses
L. Bouville,
P. H. Eagles.

Inventor
Henry Lyman Sayen,
By Dickenstein & Fairbanks,
Attorneys

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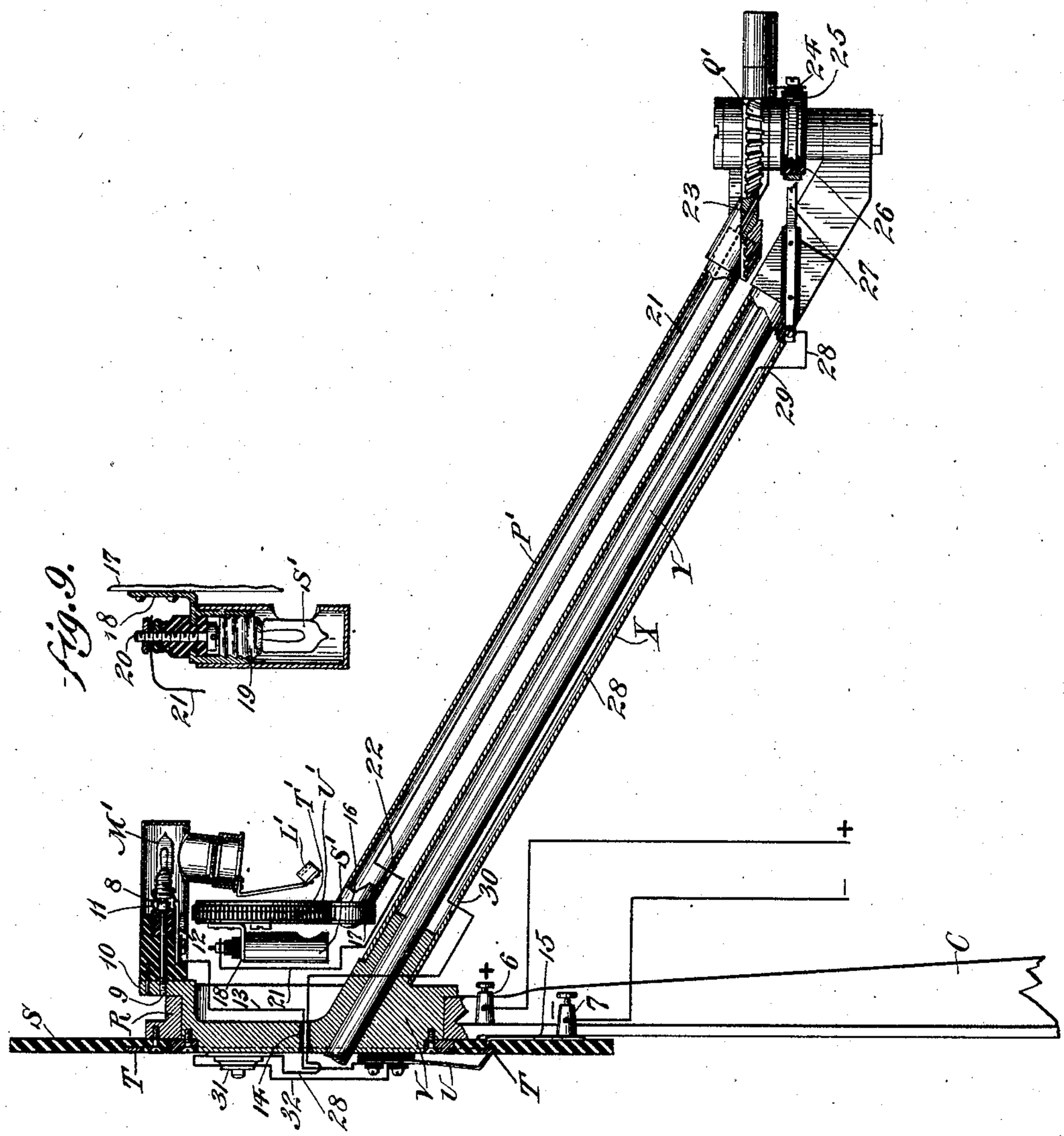
3 SHEETS—SHEET 3.



No. 785,439. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

HENRY LYMAN SAYEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO QUEEN & CO., A CORPORATION OF PENNSYLVANIA.

PERIMETER.

SPECIFICATION forming part of Letters Patent No. 785,439, dated March 21, 1905.

Application filed February 1, 1902. Renewed November 10, 1904. Serial No. 232,134.

To all whom it may concern:

Be it known that I, HENRY LYMAN SAYEN, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Perimeters, of which the following is a specification.

My invention consists of improvements in perimeters, as will be hereinafter fully described and claimed, the object being to provide a perimeter by means of which the field of vision can be reliably recorded with a high degree of accuracy and to provide for the general efficiency of a device of this character.

Figure 1 represents a side elevation of a perimeter constructed in accordance with my invention. Fig. 2 represents a top plan thereof. Fig. 3 represents an end elevation with the chart-carrying arm removed. Fig. 4 represents a section of a portion of the stand and movable arm carrying the test object. Fig. 5 represents a vertical section of a portion of the apparatus on an enlarged scale. Fig. 6 represents a section on the line *x x* of Fig. 1. Fig. 7 represents a detail of the recording-point, partially in section. Fig. 8 represents a perspective view of a modification of said recording-point. Fig. 9 represents a section of the electric lamp of the test object on an enlarged scale. Fig. 10 represents a section of the disks of the test object. Fig. 11 represents a fragmentary section of the plate and ring carrying the recording-chart.

Similar characters of reference indicate corresponding parts in the figures.

Referring to the drawings, A designates a base provided at one end with an adjustable chin-rest B of the usual form. At the other end of the base A is a standard C, upon which the arm D is pivoted, said arm being provided with a plate E and pivoted ring F, the latter being held against the plate by the spring G.

In Fig. 1 I have shown a chart H situated between the ring F and plate E, and to facilitate the insertion of the chart in the correct position the plate E is provided with the central pin J, upon which the chart is impaled, a pin-hole being made through the center of the chart before placing it in position, as will be understood. The ring F is also provided with marks 1 at the sides thereof, opposite which the ninety-degree marks of the chart are placed, it being understood that after the chart is impaled upon the center-pin it can be moved with certainty to bring the ninety-degree marks opposite these points 1. Then to hold the chart immovable in this position when the ring F is released I provide a pin 2 upon the plate E, near the upper end thereof, and the socket 3 upon the ring opposite said pin, so that when the ring is moved to the position shown in Fig. 1 the pin is forced through the upper portion of the chart, and thus the same is held at two points between the plate and ring J.

The arm D is normally supported by a spring-cushion K in the position shown in full lines in Fig. 1 away from the recording-point L, hereinafter referred to. The record of the field of vision is made in the usual manner by pressing the chart against the recording-point L, as shown in dotted lines in Fig. 1, and to insure correctness in recording I provide a projection on either the standard or arm and a socket on the other part that receives said projection when the chart is moved against the point L. In the particular construction illustrated the arm D is provided with the socket M and a pin or projection N, which is mounted upon the standard C in a position to enter said socket when a record is made, said pin being adjustable to permit a heavy or light puncture of the recording-chart, the means for adjusting the same being obtained by screw-threading said pin into a boss P by means of which it can be held by a jam-nut.

At the upper end of the standard C is a bearing formed by a ring R, and secured to the front side of this ring is a dial S of non-conducting material—rubber, for instance—in the face of which is set an annular metallic ring T, in contact with which the brush U, carried by the head V, moves. This head V is mounted to rotate within the bearing R and carries the recording-point L and the arms that carry the movable test object. The dial S is divided into arcs of one hundred and eighty degrees, and the head V is provided

with a pointer W to determine the position thereof.

Extending from the head on the side thereof opposite the chart is an arm X, conveniently at an angle of thirty degrees from the axial line of the head. This arm is preferably tubular and is provided at its ends with bearings for a shaft Y. The upper end of this shaft Y extends through the head and is provided with a gear Z on the side of said head adjacent the chart. Mounted upon a guide A′ on the side of the head adjacent the chart is a slide B′, provided with a rack C′, engaging the gear Z, while a pinion D′ is mounted upon said head and engages another rack E′ upon said slide, said pinion D′ being provided with a hand-wheel F′, by means of which it may be turned. The recording-point L is mounted upon the slide B′ by means of a bracket G′ and slotted plate H′, as shown in Fig. 7, so that by means of the screw-shank J′ and thumb-nut K′ the point L may be adjusted or removed. The adjustment of the recording-point L is necessary only when the recording-point is placed upon the machine, so as to bring the recording-point in the center of the chart when the pointer W is at zero and the test and fixing objects are in alinement with the axis of the head V.

The purpose of removing the recording-points is to allow several different fields to be plotted on the same chart—that is to say, the ordinary field of vision and the color-fields. This I accomplish by employing larger charts than ordinarily used, so that the different fields may be plainly indicated, and by employing recording-points of different characters. To illustrate this part of my invention, I have shown two different kinds of recording-points in Figs. 7 and 8. In Fig. 7 the recording-point L has a single point, while in Fig. 8 the recording-point 3 is provided with three points 4. It is understood that the recording-points, with other indicating-points, may be employed, according to the number of fields that it is intended to plot. Thus by unscrewing the end K′ it is obvious that the point L can be removed and replaced by another recording-point, such as 3.

The fixing-point of the perimeter consists of a small mirror L′, which reflects the light from an electric lamp M′, situated above it and mounted upon the head V to rotate therewith, it being noted that the mirror held thereon is concentric with the head, so as to remain at a fixed point when the head rotates. The said lamp M′ is hooded, and an opening is made in said hood so as to throw the rays of light upon the mirror L′, said mirror L′ being situated so that the angle of refraction from the light passing through said opening and striking said mirror will be coincident with the center of the arc described by the test object when the inner arm is bodily turned on its axis. The head is provided with handles N′ upon the side thereof adjacent to the chart, by means of which it can be turned.

The parts are so arranged that when the pointer W of the head is standing at zero on the dial S the arm X is in a vertical plane coincident with the axial line of the head V. When the parts are in this position, the slide B′, carrying the recording-point L, is horizontal, so that if moved by the pinion D′ it moves in a horizontal plane. Mounted upon the outer end of the arm X and upon a vertical pivot when the arm X is in the position just referred to is a second arm, P′, that is provided with a beveled gear or segment Q′, meshing with a beveled pinion R′ upon the shaft Y. The outer end of the arm P′ carries the movable test object, which consists of a small electric lamp S′, situated behind the disks T′ and U′, one of which contains openings V′ of various sizes and the other having plates W′ of different-colored glass. The length of the arm P′ is such with relation to the arm X and the mirror L′ that when it is rotated on its pivot it can pass behind the mirror L′, as shown in Fig. 1, it being noted also that the movable test object S′ always moves through a plane at right angles to the axis upon which the arm P′ rotates.

When the test object passes behind the fixing object, it is eclipsed thereby—that is to say, the test object passes directly in the rear of the fixing object—and there may be a total eclipse or only a partial eclipse of said test object. If the plates W′ of the test object are smaller or no larger than the fixing object, there would be in effect a total eclipse, but if larger it would be more on the order of an annular eclipse. By thus having the test object capable of being moved directly in the rear of or being thus eclipsed by the fixing object I am enabled to plot defects in vision nearer the center of the eye than otherwise.

It is understood, of course, that the lights forming the movable and test objects N′ and S′ can be supplied with electricity from any suitable source, and I have shown batteries 5 conveniently contained within a box mounted upon the base A, the poles of which are connected with the binding-posts 6 and 7. In Fig. 5 I have shown an enlarged view to illustrate the circuit, it being understood that both lamps are fed through these binding-posts 6 and 7. Following the circuit from the positive binding-post 6 it will be seen that it passes through the standard C and thence into the head V. The inner contact 8 of the socket of the electric lamp M′ is connected with a pin 9, that extends through the insulating-base of the socket and into a projection or leg 10 of the head V. The outside contact 11 of the socket 12 is fastened to the side of the base of the socket with a wire 13, that extends through an opening 14 in the head and is connected with the brush U, fastened to the front face of the head, but insu-

lated therefrom. As before described, the brush U contacts with the annular metallic conducting-ring T in the face of the non-conductor dial S. A conductor 15 on the rear face of the dial S is connected with said ring T and with the binding-post 7, mounted upon said dial. The circuit for the test or movable object that consists of the lamp S′ passes from the binding-post 6 to the standard C, then to the head V and through the arm X, the gears R′ and Q′ on the axis between the arms P′ and X to said arm P′, and thence through the side plates 16 and 17, between which the disks T′ and U′ are pivoted to the bracket 18, that is connected with an outer socket of the electric lamp S′, as shown in Figs. 5 and 9. The bracket 18 is connected with the outside socket 19 of the electric lamp S′.

The pin 20, extending from the inside contact of the socket of the lamp, is connected with the wire 21, that extends downwardly from the rear of the lamp and through an opening 22 into the tubular arm P′. At the lower end of the arm P′ is an opening 23, through which said wire 21 passes and is connected with a binding-post 24 upon a conductive ring 25, mounted upon an insulating-ring 26, surrounding and movable with an extension of the gear Q′. Mounted upon and insulated from the arm X is the brush 27, contacting with the ring 25, and to which is connected a wire 28, passing through an opening 29 into the tubular arm X, and thence upwardly and out through an opening 30 and then through the opening 14 in the head to a press-button 31, mounted upon said head. Another wire, 32, leads from said press-button to the brush U, above referred to, and thence to the binding-post 7. The press-button 31 is arranged to open the circuit, so as to extinguish the lamp S′ when desired.

Among the advantages which I claim for my invention is that I provide a constant test object—that is to say, the brilliancy of the test object is the same without relation to its position—or, in other words, there is no change of relation between the test object and its source of illumination. In the embodiment which I have illustrated and described this is secured by employing an electric light for the test object, which of course is a constant and regular illuminant, it being understood, of course, that suitable disks of ground or colored glass are placed in front of the electric light for obvious reasons. I have shown, however, another way in which a constant and unchangeable object can be provided in connection with the fixed object L′—that is to say, by employing a mirror which reflects the light from an electric lamp. It is further understood that this idea can be further extended by throwing reflected light upon a piece of ivory, for instance, that serves as a test object or any other way in which the relation between the test object and its source of illumination remains unchanged while the test object is moved through its arc.

Another advantage of the invention is the employment of self-luminous test and fixed objects, as contradistinguished from an illuminated object, by means of which I am enabled to treat the patient within a darkened or dark room and am thus enabled to plot the field of vision with great accuracy, as will be understood.

The gear I employ in making the different parts of the perimeter are noiseless, which is advantageous because it allows the test object to be moved into the field of vision without warning to the patient of its approach, which is of course advantageous.

The test object is movable through an arc of one hundred and eighty degrees, so that it is necessary to move the head and arm X through one hundred and eighty degrees only. For instance, as shown in Fig. 2, the arm P′, carrying the test object, can be moved on either side of the fixed object to ninety degrees, so that opposite points of the field of vision can be obtained at every point to which the arm X is moved. To illustrate, we will consider that the pointer is first moved to zero, as shown in Fig. 3, and opposite points of the field of vision obtained, it being understood that the arm P′ would then be moved as shown in dotted lines in Fig. 2. If the test is taken every fifteen degrees and the point of vision on opposite sides of the field plotted, it will be noted that when the pointer reaches one hundred and eighty degrees the entire field will have been plotted, for the test object has moved through the different longitudes of the hemisphere of which the eye of the patient is the center.

Another advantage and new result which I obtain is due to the fact that I am enabled to move the test object in the rear of the fixed object. It will be seen from the illustrations that the fixed object can be made very small, in fact smaller relatively than I have illustrated, and its support of course can be a mere wire, for instance. This allows the test object to be moved extremely close to it without being eclipsed, which is useful in plotting blind spots near the center of the field of vision.

The operation of my invention is as follows: The head of the patient being placed upon the chin-rest B in the usual manner and a recording-chart having been inserted, it is obvious that the movable test object can be moved across and beyond the line of vision to any extent by reason of the construction above described. The fixing object is employed to fix the patient's gaze, and either of the objects can be extinguished instantaneously to determine whether the records are being made from the determined object, it being understood that the tests are made in a dark room. Of course after each test is made the chart is

moved so as to contact with the pointer to make the record, and by turning the dial at certain specified intervals and moving the test-object across the field of vision, according to the case under treatment, the entire field of vision may be plotted, as before described.

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

1. In a perimeter, a movable arm carrying the recording-chart, and means for alining said arm with the recording-point of the perimeter comprising a projection upon one of said parts and a socket upon the other of said parts to receive said projection when the chart is moved into contact with the recording-point.

2. In a perimeter, a movable arm carrying the recording-chart, and means for alining said arm with the recording-point of the perimeter comprising an adjustable projection upon one of said parts and a socket upon the other of said parts to receive said projection when the chart is moved into contact with the recording-point.

3. In a perimeter, a standard upon which the movable recording-point is mounted, a movable arm provided with means for holding the recording-chart, a socket in said arm, and a projection upon said standard to enter said socket when the recording-chart is moved into contact with said projection.

4. The combination with a perimeter, of a plurality of removable and interchangeable recording-points by means of which indications of varying characteristics may be made upon the recording-chart.

5. In a perimeter, a movable arm or bracket connected with the operative parts thereof and provided with an opening, a recording-point having a screw-shank adapted to pass through said opening, and a nut engaging said screw-shank for supporting said recording-point in position.

6. In a perimeter, an illuminated test object incapable of movement relative to the source of illumination, in combination with a fixing object situated in the path of said test object, whereby the test object may be eclipsed.

7. In a perimeter, a movable test object, and means for illuminating the same movable therewith, in combination with a fixing object situated in the path of said test object, whereby the test object may be eclipsed.

8. In a perimeter, a movable test object, means for illuminating the same situated in the rear thereof, whereby the test object is situated between said means of illumination and the center of the arc described by said test object.

9. In a perimeter, a test object, means for illuminating the same, said test object and illuminating means being immovable relative to each other whereby the illumination of the test object is constant at all points in its movement, in combination with a fixing object situated in the path of said test object, whereby the test object may be eclipsed.

10. A perimeter provided with a self-luminous test object, in combination with a fixing object situated in the path of said test object, whereby the test object may be eclipsed.

11. A perimeter provided with a self-luminous test and fixing objects, said fixing object being situated in the path of the test object, whereby the same may be eclipsed.

12. In a perimeter, a movable arm provided at its free end with means for supporting the different test objects, and a light situated on the outside of and movable with said means, whereby said plate or frame is between said light and the center of the arc described by said plate or frame.

13. In a perimeter, a fixing object consisting of a reflector, and means for illuminating the same, in combination with a movable test object in the path of which said fixing object is situated and by which the test object may be eclipsed.

14. In a perimeter, a fixing object consisting of a reflector, a light, a casing or hood for said light, provided with an opening to throw rays of light upon said reflector, said opening and light being situated approximately at the angle of refraction between said reflector and the center of one of the arcs described by the test object of said perimeter.

15. In a perimeter, a rotatable arm extending at an angle to its axis of rotation, a second arm rotatable upon an axis at a right angle to the axis of rotation of said first-mentioned arm, said second arm extending at an angle to its axis of rotation, a fixing object coincident with the axis of rotation of said first-mentioned arm, a test object carried by said second arm and adapted to intersect the axis of rotation of the first-mentioned arm, a recording-point movable with said test object, and a chart.

16. In a perimeter, a rotatable head mounted upon the frame thereof and provided with a relatively immovable fixing object concentric therewith, an angular arm upon said head, a second arm mounted upon said first-mentioned arm and movable through an arc the plane of which is at right angles to the axis of said head, and a movable test object carried by said second arm and adapted to intersect the axis of said head.

17. In a perimeter, a head mounted to rotate in suitable bearings and provided at one side with an angular arm, a second arm mounted upon said first-mentioned arm and provided with a test object, a fixing object, a movable recording-point mounted upon said head and geared to a shaft extending through said first-mentioned arm, said shaft being geared to said second arm; and a recording-chart.

18. In a perimeter, a standard provided with a bearing, a head rotatably mounted therein

and provided with an angular arm, a second arm rotatably mounted upon said angular arm and carrying the test object, a fixing object, a shaft extending through said first-mentioned arm and geared to said second arm, a slide mounted upon said head and connected with said shaft to cause the same to rotate, a recording-point carried by said slide, means for moving said slide longitudinally, and a recording-chart.

19. In a perimeter, a standard provided with a dial, a head rotatable within a bearing in said standard and having an indicator coacting with said dial, an angular arm upon said head, a second arm rotatably mounted upon said angular arm and provided with a test object, a fixing object concentric with said head, a movable recording-point mounted upon said head and connected with said second arm to be movable therewith when the latter moves relative to the first-mentioned arm, and a recording-chart.

20. In a perimeter, a metallic standard having a bearing, a metallic head rotatably mounted therein and carrying the operative parts of the apparatus, an electric-lamp socket mounted upon said head, the inner contact of said socket being electrically connected with said head, a conductor leading from the outer contact of said socket to a brush carried by said head, an annular conductor concentric with said head and engaged by said brush, and binding-posts connected with the standard and with said annular conductor.

21. In a perimeter, a movable test object consisting of an electric lamp, a normally closed circuit therefor, and means for opening said circuit, in combination with a fixing object situated in the path of said test object, whereby the latter may be eclipsed.

22. In a perimeter, a metallic standard, a metallic head mounted in bearings thereon, an arm upon said head, a second arm pivoted upon said first-mentioned arm and carrying a test object comprising an electric lamp, the outer contact-socket of said lamp being electrically connected with a binding-post on said standard through said arms, said head and said standard, and the inner contact of the socket of said lamp being connected with a conductor leading to a circular contact-piece rotatable with said second arm, a brush upon said first-mentioned arm engaging said contact-piece, and a conductor connected with said brush and extending through said first-mentioned arm and then downwardly and to a brush mounted upon said head, a contact-strip concentric with said head with which said brush contacts, and a binding-post connected with said brush.

23. In a perimeter, a fixing object, and a test object movable through an arc between which and the center thereof said fixing object is situated, whereby the test object may be eclipsed.

24. In a perimeter, a fixing object, and a test object movable through an arc in the plane of which and between said arc and its center said fixing object is situated, whereby the test object may be eclipsed.

25. In a perimeter, a fixing object, and a movable test object adapted to be moved to the rear of said fixing object, to eclipse said test object.

26. In a perimeter, a rotatable arm extending at an angle to its axis of rotation, a second arm rotatable upon an axis at a right angle to the axis of rotation of said first-mentioned arm, said second arm extending at an angle to its axis of rotation, a fixing object coincident with the axis of rotation of said first-mentioned arm, and a test object carried by said second arm and adapted to intersect the axis of rotation of the first-mentioned arm.

HENRY LYMAN SAYEN.

Witnesses:
JOHN A. WIEDERSHEIM,
HENRY COBB KENNEDY.