

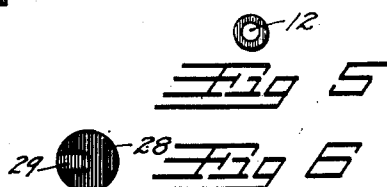
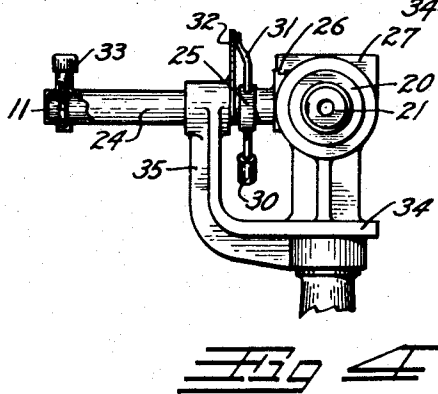
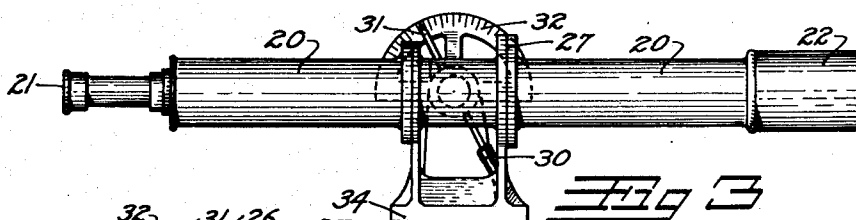
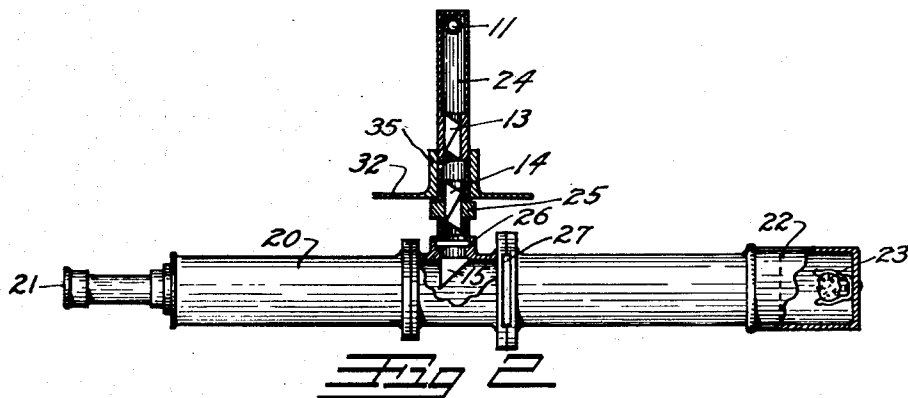
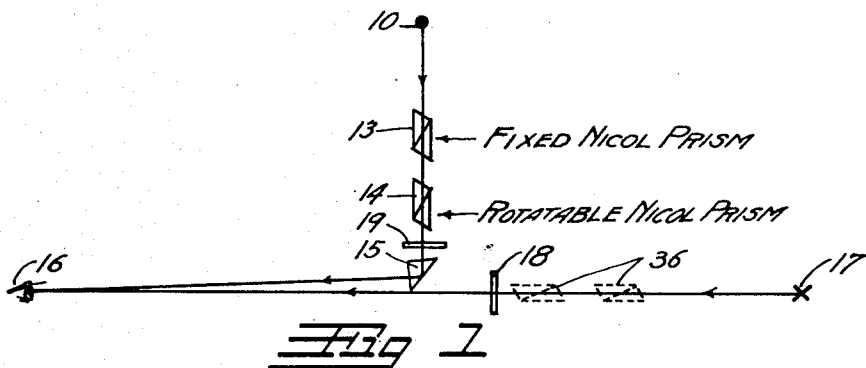
Sept. 1, 1925.

1,551,843

R. E. NYSWANDER

PHOTOMETER

Filed Dec. 31, 1923



INVENTOR.

R. E. NYSWANDER

BY

R. E. Nyswander
ATTORNEY.

UNITED STATES PATENT OFFICE.

REUBEN E. NYSWANDER, OF DENVER, COLORADO.

PHOTOMETER.

Application filed December 31, 1923. Serial No. 683,717.

To all whom it may concern:

Be it known that I, REUBEN E. NYSWANDER, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Photometers, of which the following is a specification.

This invention relates to photometers for the quantitative measurement of light, in which a photometric balance is obtained between two brightnesses, one illuminated by a standard light and one by a comparison light.

It has been impossible to use any of the present photometers for the comparison of lights of exceedingly low intensities, owing to the difficulty in obtaining a standard light source whose intensity is sufficiently uniform and sufficiently low. It can be readily seen that any variation in the standard light must be greatly less than the total intensity of the light to be compared, thus, if the comparison light has an intensity exceedingly low, the variation in the standard light must be exceedingly less than this intensity or practically zero. No source at present in visual photometric comparison is absolutely uniform and therefore such photometric comparisons of light sources of exceedingly low intensities have not been possible.

The principal object of this invention is to provide a source for the standard light which will be of very low intensity and of practically perfect uniformity, such that it may be used, if necessary, to compare lights whose intensities approach the threshold or extinction value.

A further object is to provide efficient and accurate means for employing my new standard source in photometric comparisons.

Other objects and advantages reside in the use of my new standard source and in the means employed to use the same. These objects and advantages will become apparent from the following description and are anticipated by my invention.

In the following detailed description of the invention reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:—

Fig. 1 is a diagram of a method of employing my new standard illuminant in photometric comparison.

Fig. 2 is a plan view of a photometer in which the optical system shown in Fig. 1 is embodied.

Fig. 3 is a side elevation of the photometer shown in Fig. 2.

Fig. 4 is an end elevation of the same.

Fig. 5 is a detail view showing an alternate form of standard source to be later described.

Fig. 6 is a detail view showing the field of vision of the photometer illustrated.

I employ as my standard source of light a luminescent radio-active substance, such as a radium zinc sulphide compound or some other radio-active luminous compound.

The light first emitted by a radium zinc sulphide compound has been found to vary in intensity for a period of approximately 500 days, after which it becomes sensibly constant. This uniformity is practically permanent.

Since any variations in the uniformity of the light emitted by such a compound, if it be protected from external light, is only detectable over long periods of years, if at all, such a light source forms an ideal standard for the photometric comparison of lights of lesser intensities. Any variation which could possibly occur during a period of comparison would be so infinitely small that it can be safely said that such a standard source is uniform and constant.

In the drawing the numeral 10 designates such a light source, which may be contained in a glass tube such as indicated at 11, Figs. 2 and 4; or painted or deposited on a disk such as shown at 12, Fig. 5; or used in any other desired manner. The disk could be inserted in the photometer tube in the place of the tube 11.

Referring to the diagram of Fig. 1, the light from the standard source 10 is passed through a fixed Nicol prism 13, thence through a rotatable Nicol prism 14 into a right angle prism 15, from which it is reflected to the eye of the observer 16. The compared light is placed at 17, where it can be observed adjacent to the reflection of the standard light 10.

The Nicol prism 13 polarizes and reduces the intensity of the light, received from the standard source 10, one-half. Should the compared light be of less than one-half the intensity of the standard, the Nicol prism 14 is revolved until the visual brightness of the two sources are identical. The amount of revolution of the prism 14 is the index of the light being compared. The action of the two Nicol prisms on the light is too well known to those skilled in the art to need description here.

Should the comparison light be of greater intensity than the light received from the standard, screens of varying and known degrees of transparency, which may be obtained on the market, are interposed, as indicated at 18, in the path of light until the intensity has been reduced below the intensity of the light from the standard source. The standard light is then reduced by polarizing adjustment of the Nicol prisms as above described. Nicol prisms could be used in the place of the screens 18 as indicated in broken line at 36.

The comparison of light as described in the foregoing is based on the assumption that they differ but little in color from the standard light. Should the difference be inconveniently great, color screens are used, as shown at 19, to color the rays from the standard light to correspond to that of the comparison light. However, when comparing lights of exceedingly small intensities, the differences in color practically disappear so that the color values may usually be ignored.

A form of apparatus for the use of my new source of light is shown in Figs. 2, 3, 4, and 6, in which the numeral 20 designates a tube having an eye piece 21 at one extremity and at the other extremity of which the comparison light is placed. In the drawing a cap 22 is provided having a clamp for holding a piece of light emitting substance 23, the light from which is being compared. The cap 22 could be replaced by any desired apparatus such as an electric furnace, lamp, telescope, microscope, calorimeter, etc., as required.

Projecting from the side of the tube 20 is a small tube 24, in the extremity of which the standard light source, as above described, is placed. In the drawing a light tight container 33 is shown for the reception of a tube of radio-active luminescent compound.

The Nicol prisms are mounted in the tube 24, the prism 13 being fixed therein and the prism 14 being carried in a sleeve 25 which is rotatable within the tube 24. A socket for the color screens 19 is shown at 26 and a socket for the diminishing screens 18 is shown at 27.

The right angle prism 15 is placed at the point of intersection of the tubes 20 and 24

so as to project into the interior of the tube 20.

The observer's field of view is shown in Fig. 6, in which the light from the comparison source is indicated at 28, and the light from the standard source is indicated at 29.

A handle 30 is fixed on the collar 25, by means of which the Nicol prism 14 is revolved. A pointer 31, also fixed on the collar 25, indicates on a graduated scale 32 the degree the prism 14 has been revolved.

The tube 20 is supported on a base 34, from which an L shaped arm 35 radiates for the support of the tube 24. The base 34 may be supported in any suitable manner.

The indications from the graduated scale 32 may be compared with a graphic curve, which has been plotted by the use of a photo-electric cell or similar means for the particular Nicol prisms in use, and the percentage of the light reduction obtained, or may be computed by use of the formula $a^2 \cos^2 \theta$ in which, a is the amplitude of the light after emerging from the first Nicol and θ is the angle between the principal sections of the two Nicol prisms. For relative measurements, the value of a need not be known. The scale 32 could be graduated to read direct in percentages of reduction but since this would vary with various prisms, it would probably be more economical in manufacture to calibrate a curve for each set of prisms, leaving the scale graduations uniform on all devices.

While I have described in some detail one method of making use of my improved standard light source, together with the theories which I believe best explain its success in use, it is understood that my invention is not limited to the procedure described nor is it dependent upon the accuracy of the theories which I have advanced. On the contrary, my invention is not to be regarded as limited except in so far as such limitations are included within the terms of the accompanying claims, in which it is my intention to claim all novelty inherent in my invention as broadly as is permissible in view of the prior art.

The term "radio-active" as used in this specification is not to be construed as limited to those compounds containing radium as an element.

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

1. A photometer comprising a tube; an eyepiece at one extremity of said tube; means for supporting a comparison light source at the other extremity of said tube; a second tube projecting normally from the first said tube; means for supporting a self-luminous standard light at the extremity of said second tube; a prism arranged at the

intersection of said tubes and projecting into said first tube so as to reflect light from said standard light toward said eyepiece and means for varying the intensity of the light
5 passing from said standard light to said prism.

2. A photometer comprising a supporting member; a sight tube rigidly carried on said supporting member; a standard light tube
10 rigidly carried on said supporting member, out of contact with, and projecting normally from, said sight tube; a rotatably mounted

connecting tube between said sight tube and said light tube; means for indicating the amount of rotation of said connecting tube;
15 Nicol prisms carried by said connecting tube and said light tube and a totally reflecting prism secured at the point of contact between said connecting tube and said sight tube
20 and arranged to reflect light rays from said light tube longitudinally through said sight tube.

In testimony whereof, I affix my signature.
REUBEN E. NYSWANDER.