Feb. 10, 1931. F. SKAUPY 1,792,046

ARRANGEMENT FOR SINGLING OUT PARALLEL MONOCHROMATIC LIGHT RAYS FROM A CONE OF LIGHT

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Fig. 1

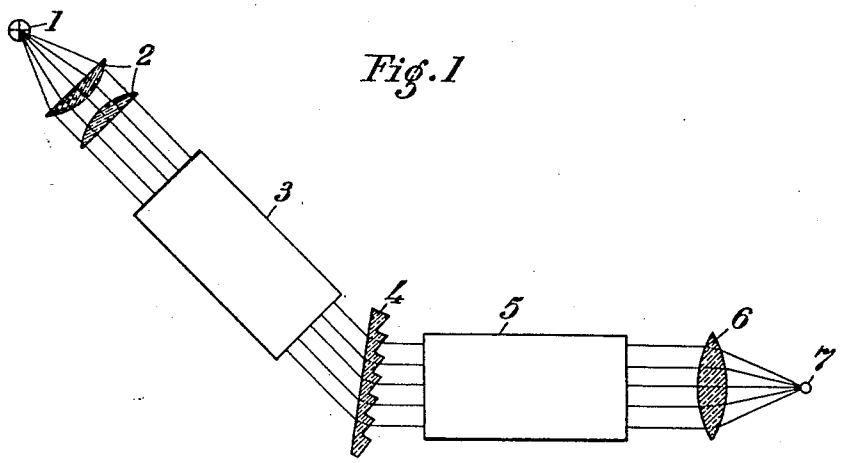


Fig. 2

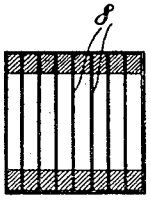


Fig. 3

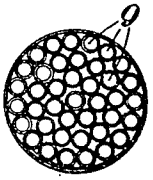


Fig. 4

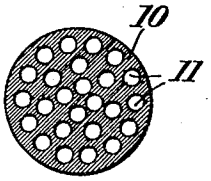
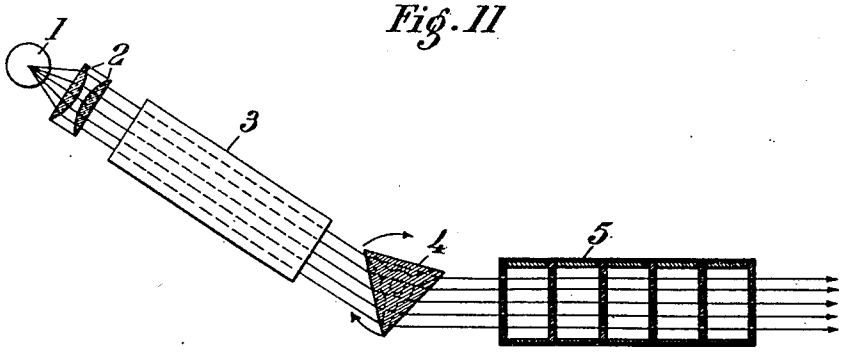


Fig. 11



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Fig. 5

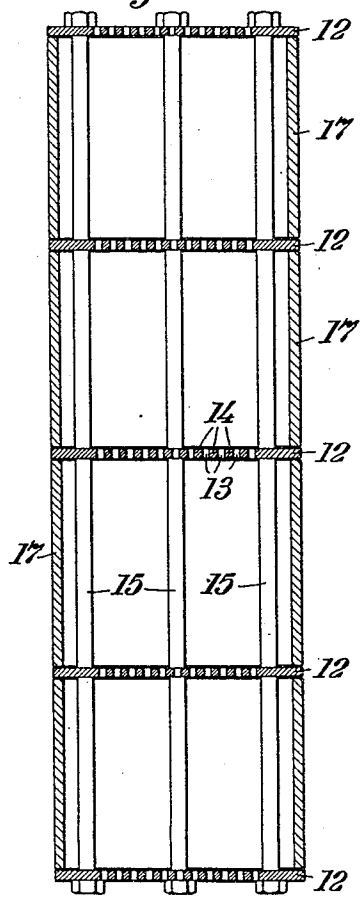


Fig. 7

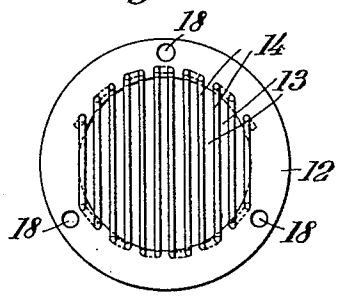


Fig. 8



Fig. 9

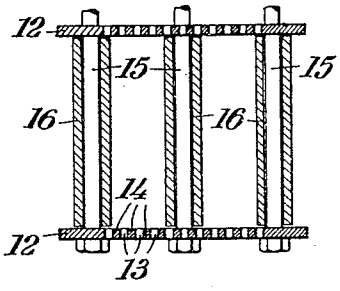


Fig. 6

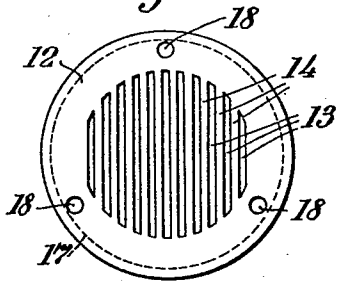
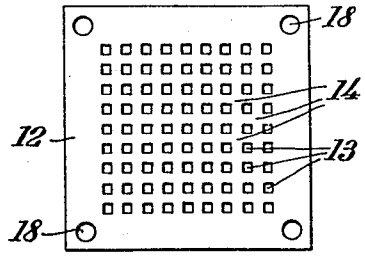


Fig. 10



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UNITED STATES PATENT OFFICE

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ARRANGEMENT FOR SINGLING OUT PARALLEL MONOCHROMATIC LIGHT RAYS FROM A CONE OF LIGHT

Application filed February 4, 1929, Serial No. 337,437, and in Germany December 14, 1927.

This invention relates to a monochromatic singling out of rays of a certain color from a cone of light rays. According to the invention the cone of light rays is conducted through channels, the walls of which are parallel to the rays to be singled out and of such kind that the rays which have an undesirable color are absorbed. The rays of the light cone which possess already the desired color can pass freely through the channels. In order that no undesirable rays pass through the diaphragm, as the system of channels shall be hereinafter called, these channels must be sufficiently narrow and sufficiently long. The diaphragm is preferably arranged in such a position with regard to the light rays that from the beginning the greater portion of the rays extend as far as possible parallel in the channels, a good yield being thus obtained. The production of parallel light is very desirable for various purposes and permits to solve problems which hitherto could only be imperfectly solved. An important application of the invention is the construction of a monochromater for larger flows of light. The commonly used monochromaters work generally by means of a gap which allows only a very small fraction of the flow of light supplied by the source of light to pass through, so that it is decomposed into the differently colored components.

For numerous, specially practical purposes considerably stronger light flows of spectrally decomposed light are required, for instance for medicinal radiating purposes, said light being adapted to be obtained, according to the invention, by directing as parallel as possible the light coming from a source of light, as much as possible dot-shaped (for instance a tungsten arc lamp), first by a condensor or mirror, whereupon by means of a diaphragm similarly constructed as that by which according to the invention rays of undesired direction are eliminated, the other rays being then thrown without the use of a gap upon a prism.

The large light cone coming from the prism is composed of rays which are no longer parallel but have different directions according to their colors. If these light rays are then made to pass through a diaphragm according to the invention only the rays of a certain direction and color are allowed to pass, the remaining rays being absorbed.

The range of the light waves passing through the diaphagm is the smaller, i. e. the light is the more monochromatic, the narrower and the longer the channels are.

In this manner it is possible to make useful for medicinal radiation or for illuminating effects a great percentage of the light flow striking onto the condensor or mirror and coming from the corresponding range of wave length. With the aid of the same diaphragm light of any desired wave length can be obtained in rapid succession from the apparatus, when diaphragm and prism are arranged so that they can be mutually moved. When the length and width of the channels are selected so that, at a suitable position of the diaphragm, the entire visible ray range is allowed to pass through, however not the heat rays, the apparatus yields a practically cold light, this being important for different purposes (cinematographs, episcopes). The heat rays and the visible rays may also be absorbed and only the ultraviolet rays or a portion of the same may be singled out.

Instead of a system of channels with parallel walls, which absorb the rays of undesired direction, several diaphragm plates may be inserted in the path of the light rays so that they are suitably spaced and have at convenient points in the direction of the desired rays openings (slots, holes), so that the rays of undesired direction are absorbed by the solid bridges between the openings, the rays of the desired direction passing freely through the holes of the several diaphragm plates, said holes being situated accurately in the same direction. The bridges between the holes are blackened. The bridges corresponding with each other act with their spacings as a whole like a blackened wall. The spacings of the plates and the width of the openings and of the solid portions between the openings in one plate are selected in accordance with the divergence of the light cone

and the desired degree of parallelity of the rays to be singled out. The diaphragm plates are preferably united by intermediate elements to form a diaphragm body.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing in which:

Fig. 1 shows diagrammatically a monochromater according to the invention.

Figs. 2, 3 and 4 show each a different form of the diaphragm,

Figs. 2 and 4 in cross-section and

Fig. 3 in end elevation.

Fig. 5 shows the diaphragm body composed of several diaphragm plates connected with each other by intermediate elements.

Figs. 6 and 7 show each a diaphragm plate as used in Fig. 5,

Fig. 8 is a cross-section of Fig. 7.

Fig. 9 shows in cross-section two diaphragm plates spaced by tubular spacers.

Fig. 10 shows a diaphragm plate of modified construction.

Fig. 11 shows a complete arrangement for singling out certain relatively narrow spectral ranges from a spectrally decomposed light cone.

In Fig. 1 the source of light is designated by 1, a condensor by 2, a diaphragm similar to that according to the invention having however preferably white walls by 3. 4 is a stepped prism, 5 a second diaphragm with black walls, 6 an optical system, for instance a lens, for collecting or dispersing the cone of parallel colored rays coming from the diaphragm 5. The rays can be caught on a surface or as shown in Fig. 1 collected in a focus 7. For the step prism 4 a number of prisms might be substituted the inclined faces of which are parallel to each other.

The diaphragms may be made in different manners; they may consist of a number of parallel plane sheet metal plates 8 spaced at convenient distance (Fig. 2), or of a bundle of thin walled tubes 9 (Fig. 3) or of a massive body 10 having parallel cylindrical bores 11 (Fig. 4). This body 10 might be produced either by drilling cylindrical channels in a solid body, by casting a plastic mass around parallel rods, said rods being removed after the plastic material has solidified, by extruding, by rolling or by drawing. The walls of the bores must be blackened, unless the material itself is of the desired color so that the walls of the bores are dull. The diaphragm walls must be as thin as possible, in order that the cross-section of the passages for the light is as large as possible and the maximum yield is obtained.

When large flows of light are used, the diaphragm may be fitted with air- or water-cooling.

In Fig. 6 plates 12 having holes 13 and bridges 14 between the holes are mounted on rods 15 and spaced by spacers, either tubes 16 as shown in Fig. 9 or rods 17 as shown in Fig. 6.

The diagram plates with the holes 13 and with holes 18 for the connecting rods 17 (Figs. 6, 7 and 8) can be produced in large quantities, for instance by stamping from sheet metal, same as the other elements of which the diaphragm bodies are composed.

As shown in Fig. 7 the bridges 14 are formed by a wire or thread passed through holes near the inner edge of the ring-shaped diaphragm.

The apparatus is specially designed for singling out predetermined, relatively narrow spectral ranges from a spectrally decomposed light cone, the diaphragm body being mounted behind the decomposing position in the path of the light rays diverging according to their color in different directions. In this manner a great portion of the flow of light from the source of light can be utilized and by rotating an element of the apparatus, for instance the prism, around an axle parallel to the refracting edge different spectral ranges can be successively isolated. For reflectors, specially for scene lighting, for optical signals in the sea- or air-traffic, for medicinal radiations by rays of certain wave lengths, and also by ultraviolet and infra red rays, such arrangements can be used successfully.

A complete arrangement of this kind is shown in Fig. 11, an other suitable prism being substituted for the stepped prism 4 in Fig. 1. The diaphragm 5 is arranged so that it allows to pass only the desired portion of the spectrum.

I claim:—

1. An apparatus for singling out light rays of a certain color from a cone of light rays, comprising in combination with the source of light, means for giving to the light rays an approximately parallel direction, a prism for decomposing the light rays into groups of different colours and therefore directions, and a diaphragm comprising a number of narrow parallel passages for the light rays having light absorbing walls.

2. An apparatus for singling out light rays of a certain color from a cone of light rays, comprising in combination with the source of light, a condenser adapted to give to the light rays an almost parallel direction, a diaphragm behind said condenser comprising a number of narrow parallel passages adapted to give to the light rays an accurately parallel direction, a prism for decomposing the light rays into groups of different colours and therefore directions, and a diaphragm comprising a number of narrow parallel passages for the light rays having light absorbing walls.

3. In an apparatus as specified in claim 1 the diaphragm designed for singling out rays of a certain color for a spectrally decomposed

cone of light rays composed of a number of plates having each holes, the holes of all the plates registering accurately, and means for spacing the same at the desired distance.

4. In an apparatus as specified in claim 1 the diaphragm designed for singling out rays of a certain color from a spectrally decomposed cone of light rays composed of a number of plates having each holes, the holes of all the plates registering accurately, and longitudinal rods for securing said plates in the desired position and for spacing the same at the desired distance.

In testimony whereof I affix my signature.

FRANZ SKAUPY.