Feb. 28, 1939. P. MÜLLER 2,148,574

NONDAZZLE LAMP

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Fig. 1.

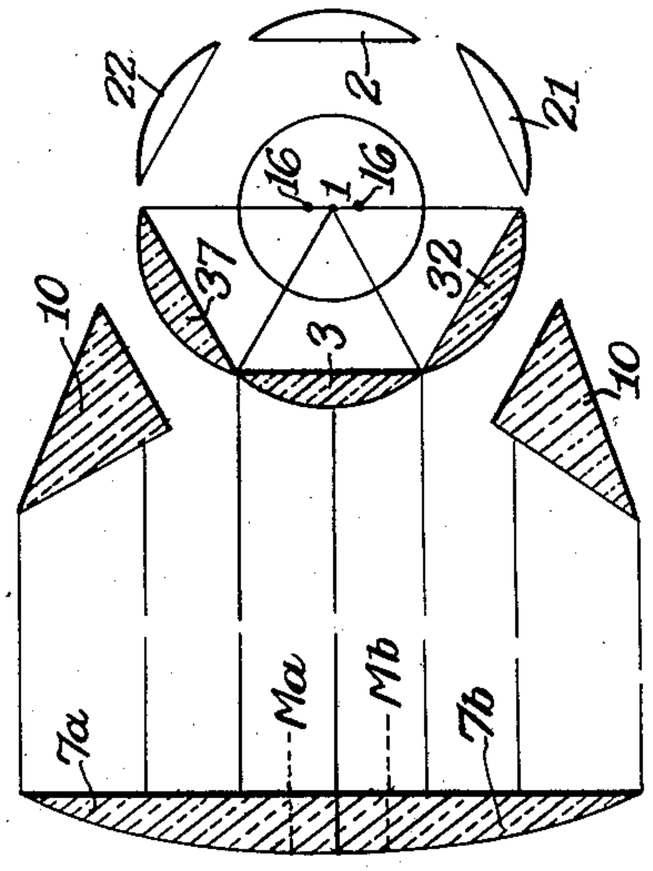


Fig. 4.

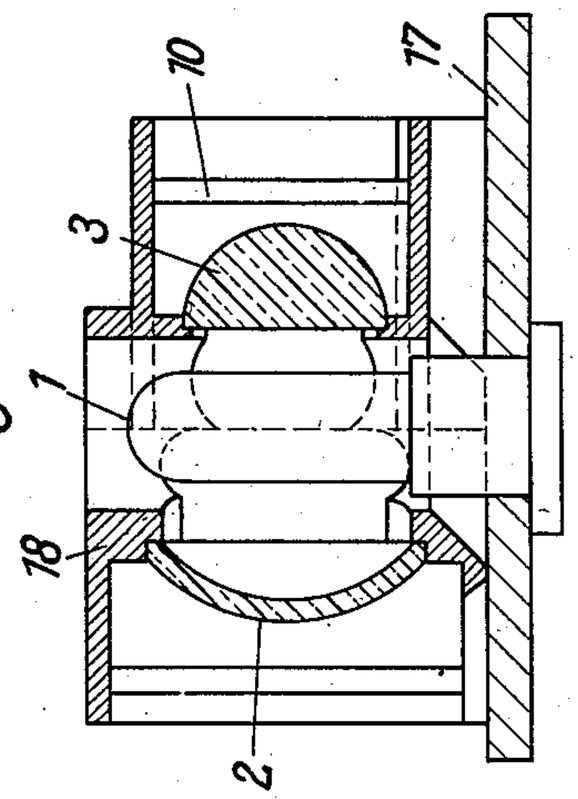


Fig. 2.

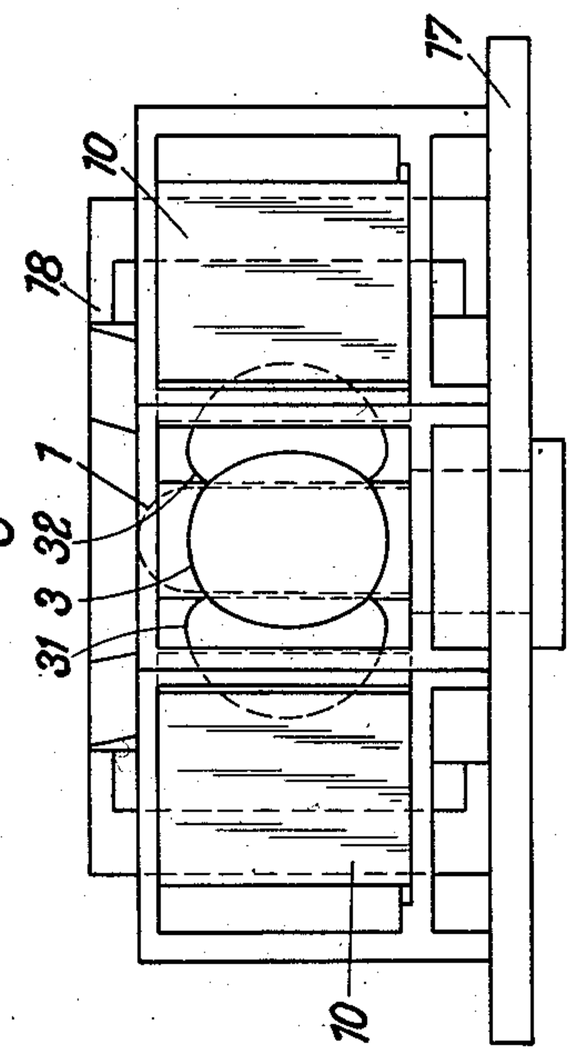
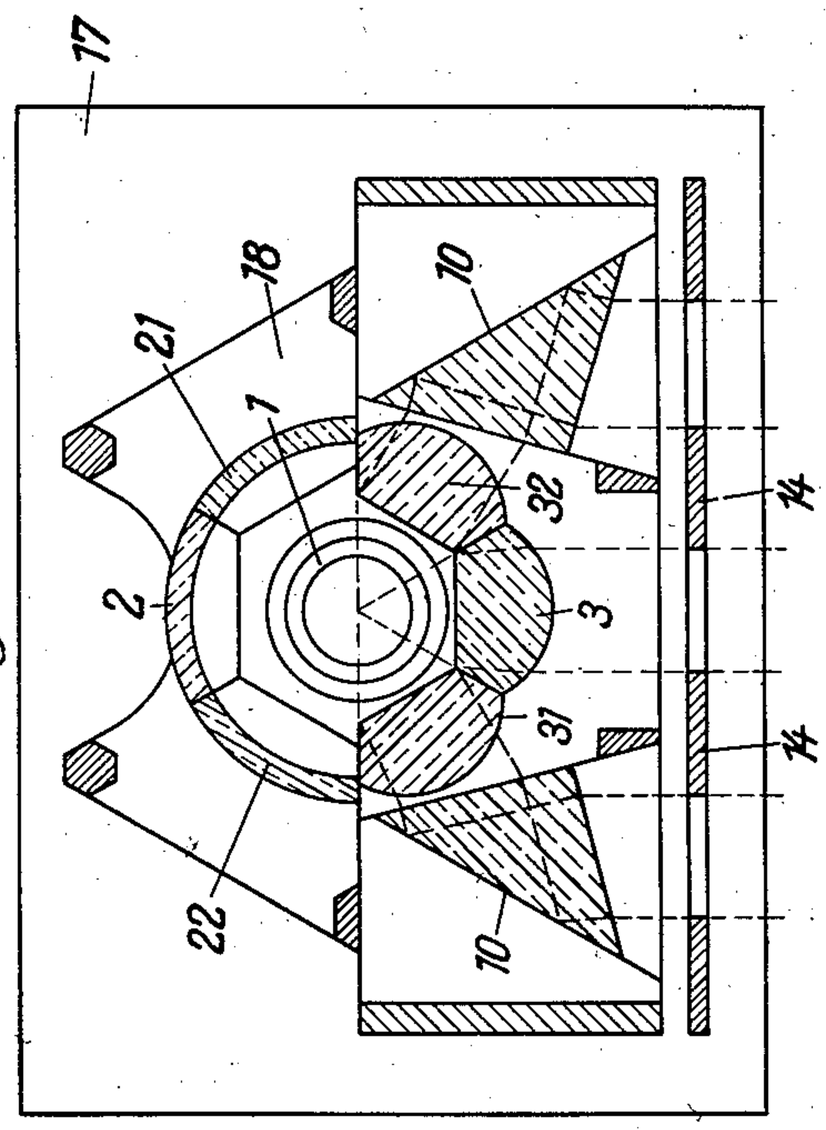


Fig. 3.



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NONDAZZLE LAMP

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Fig. 5.

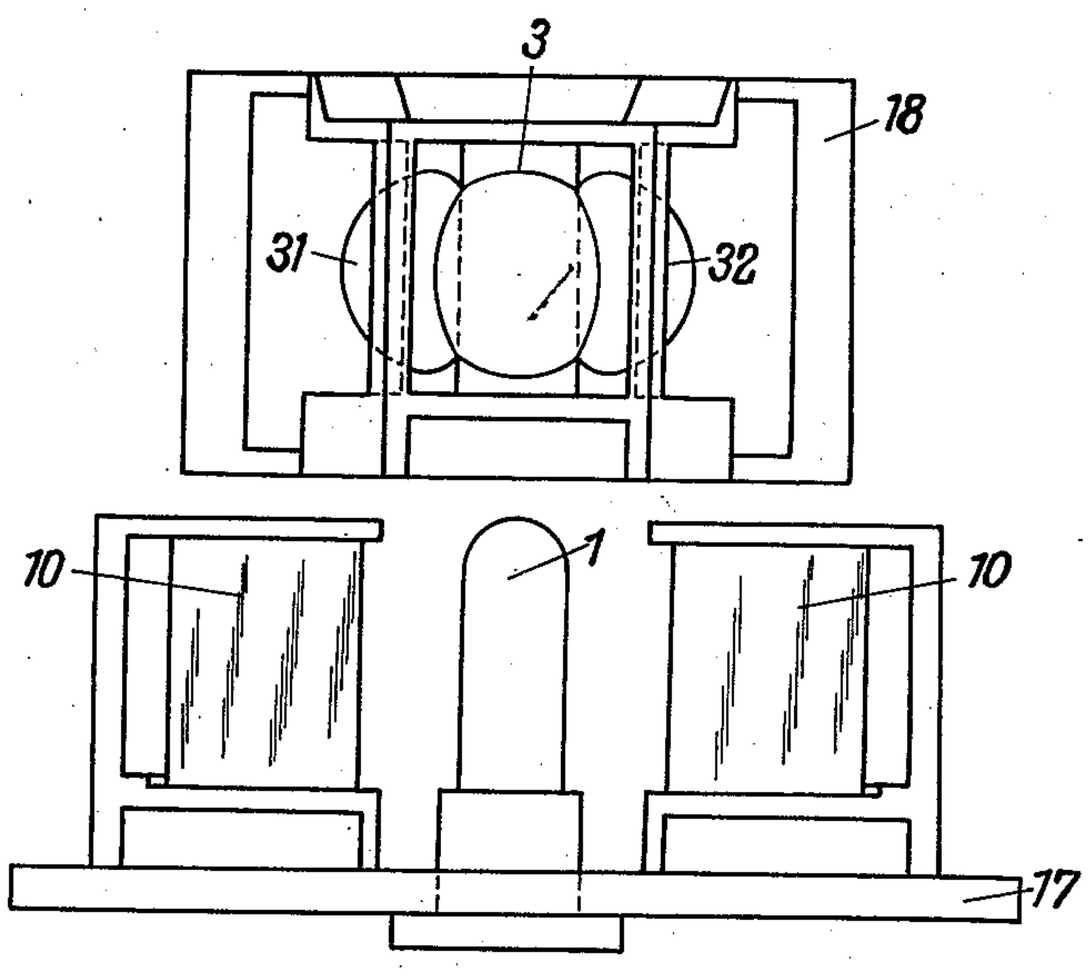


Fig. 6.

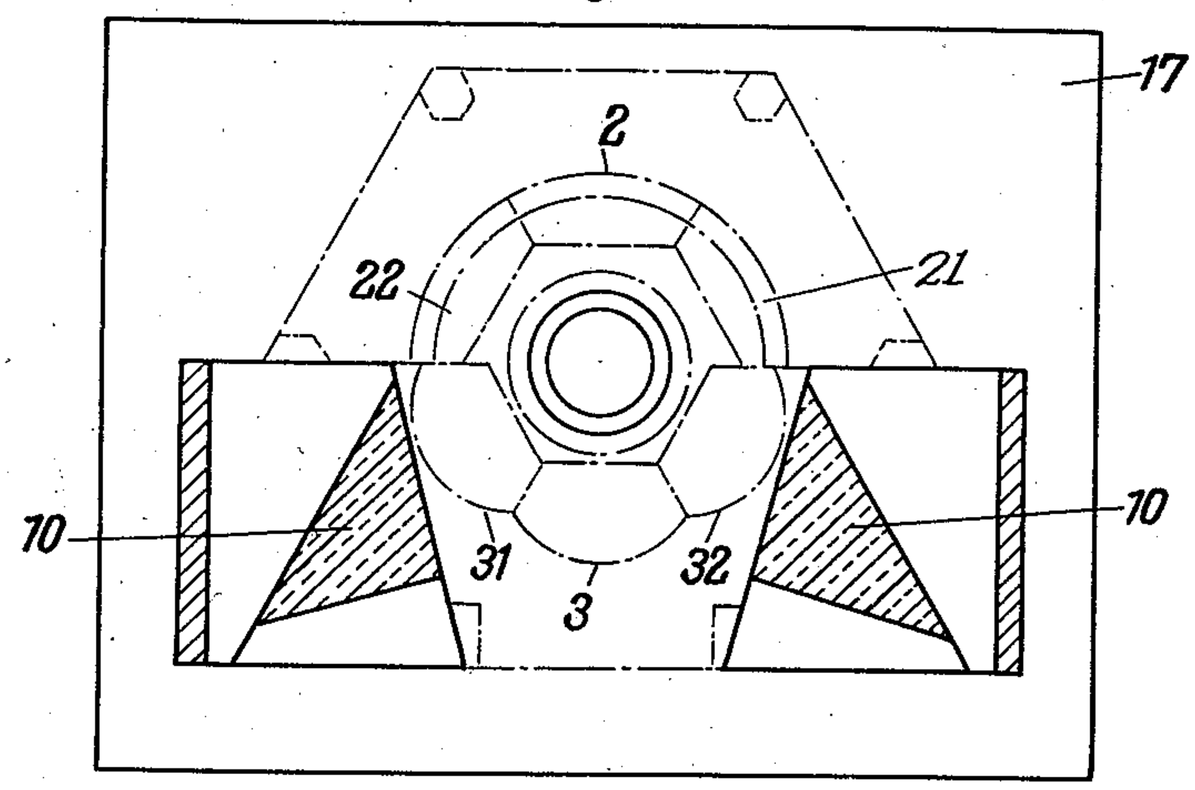
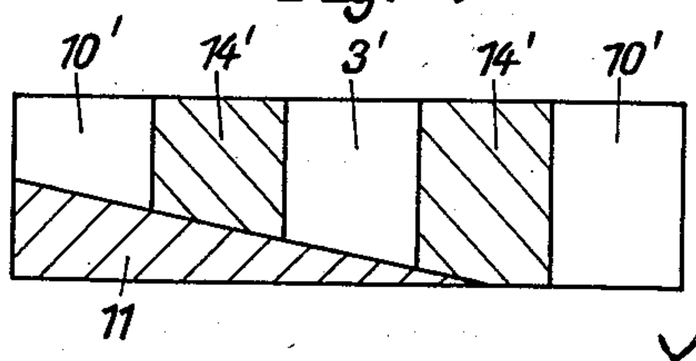


Fig. 7.



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NONDAZZLE LAMP

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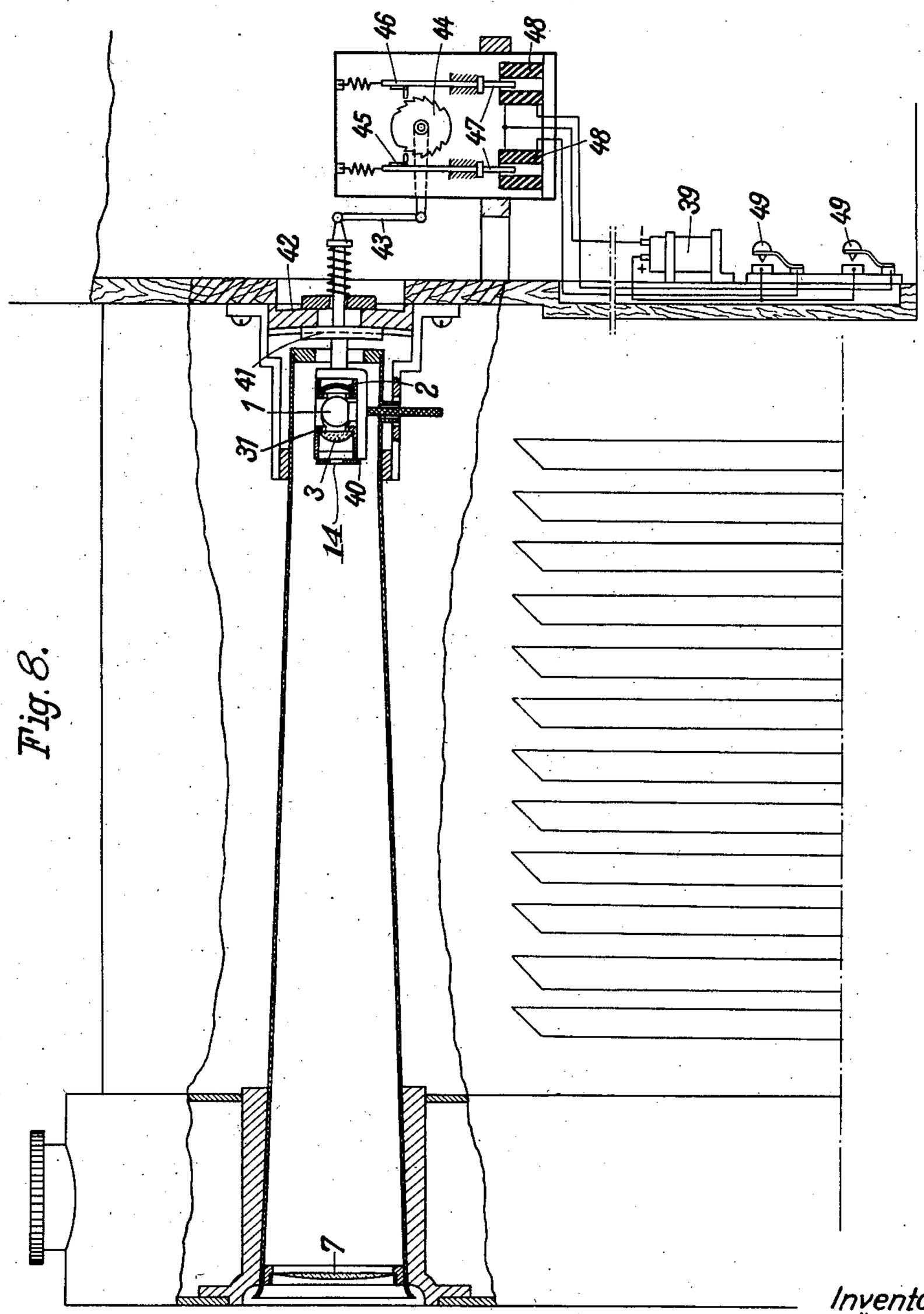

Fig. 8.

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UNITED STATES PATENT OFFICE

2,148,574

NONDAZZLE LAMP

Paul Müller, Berlin-Friedrichshagen, Germany, assignor to Julius Pintsch Kommanditgesellschaft, Berlin, Germany

Application May 21, 1936, Serial No. 80,932
In Germany May 28, 1935

8 Claims. (Cl. 240—41.3)

This invention relates to non-dazzle lamps for illuminating streets, roads or the like, and is concerned primarily with headlamps mounted upon vehicles, although it is also applicable to stationary lamps set along streets, roads and the like.

It is necessary in the illumination of motor roads that there shall be a complete absence of dazzle for the drivers, that is to say, that dazzling light shall not issue from the lamps above a certain altitude or laterally beyond a certain angle. Care must therefore be taken that the light is sharply defined or limited beyond these planes, and this requirement is fulfilled only to an incomplete extent with the usual constructions of lamps. The spatial construction of the illuminating element, e. g. the filament of an incandescent lamp, opposes the sharp definition of the beam. The different radius vectors, for example of a parabolic reflector, which even from the peak focal width to the parameter increase in the ratio of 1:2, always give a hazy edge to the cone of light, so that the transition from complete darkness to maximum brightness occurs in an angle which does not allow a complete freedom from dazzle with the ranges of head-lights, for instance, which are now required.

In particular, the direction in which the construction of motor roads now tends to develop, with long straight stretches to permit increased speeds, has made new demands in regard to the construction of car head-lights. It has become necessary to provide a long range head-light which casts onto the road a beam that is sharply defined at the upper edge. In addition it is required that the intensity of the light shall increase as it gets further away from the car, the light source being utilized in the best possible way, whilst the angular range covered by the head-light should decrease with increasing distance from the car.

According to the present invention I depart from the principles hitherto usual in the construction of head-lights, and do not produce a beam of suitable convergence by means simply of a lens disposed near the light source. Instead, I arrange to illuminate a lens of great focal length by means of condensing lenses, so that the said lens produces a sharply defined image of the luminous area produced in the condenser system. I may also provide baffles in front of the luminous area of the condenser system for the purpose of defining the beam vertically and laterally as desired.

In order to create a beam the brightness of which increases the greater the distance from the light source, whilst its angular range decreases, I provide in the condenser, according to a further feature of the invention, a plurality of lenses or lens parts having increasing focal length and diameter from lens to lens.

Other features and advantages of my invention, and methods of embodying the same will become apparent in the following description and appended claims.

Examples of embodiments of the invention are illustrated in the accompanying drawings.

Fig. 1 shows in plane the condenser system which forms an important part of the present invention,

Figs. 2, 3 and 4 are more detailed illustrations showing the mounting and construction of the condenser lenses and prisms according to Figure 1 in elevation, plan and side view respectively,

Figs. 5 and 6 are elevation and plan respectively of the same arrangement with the lens system raised,

Fig. 7 is a front view of the screen 14, shown in Figure 3, arranged in front of the condenser system,

Fig. 8 shows the installation of a head-lamp according to previous figures in the bonnet of an automobile.

The system illustrated diagrammatically in plan in Figure 1 includes besides the light source 1 and the spherical mirror 2 and lens 3 two further lenses 31 and 32 with corresponding reflectors 21 and 22. The two laterally disposed lenses 31, 32 cause the formation of two further beams which, however, diverge laterally very greatly. These lateral beams are collected by two total reflecting prisms 10 or two plane mirrors and are guided towards the projection lens 7 like the beam from the central lens.

In order that a continuous unbroken and uniform illumination shall be obtained by the superposition of two cones of light consisting of bright and dark zones produced by a device as above described, the widths of the individual light beams and the interspaces must be exactly the same, and therefore the mirrors or prisms must be arranged very near to the condensing lenses. Various difficulties arise in this connection, particularly in the assembly or cleaning of the apparatus. It is also difficult to bring the light source exactly into the required position.

These difficulties are overcome by arranging the lenses surrounding the light also, and also if necessary the concave mirrors on a carrier

that is readily removable from the apparatus. The light source itself may either be arranged also on this carrier so that it is removed when the carrier is removed, or it may be arranged on the part of the apparatus carrying the prisms, which is more advantageous in many cases. The light source is then easily accessible when the said carrier is removed, so that not only can it be removed or replaced without difficulty, but also it is possible to effect adjustment so that, for example, the light beam is cast at a predetermined place by a suitably arranged lens.

Figs. 2, 3 and 4 show an embodiment of such an arrangement in front elevation, plan and side elevation respectively. The deflecting prisms **10** and the light source **1** are fixed to the base plate **17**. The light source is surrounded in a semi-circle by three projecting lenses **3**, **31**, **32** of short focal length, and the circle is completed by the spherical mirrors **2**, **21** and **22**.

To avoid the light reflected by the mirrors **2**, **22**, and **21** having to pass through the light source, the centres of curvature **16** of these mirrors are preferably displaced laterally somewhat away from the light source.

As shown in Fig. 3, the spaces between the two lateral projection lenses **31**, **32** and the deflecting prisms **10** are only very small. Likewise the space within the prisms and the concave mirrors is practically wholly taken up by the glass parts surrounding the light source.

In front of the system the baffles **14** shown in Fig. 3 only, for the sake of clearness are arranged in the focal plane of the head-light lens **7**. This lens **7** will in this case consist of two parts **7***a* and **7***b*, the centres M*a* and M*b* of which are displaced somewhat by the width of the baffles **14** or by the same width as the spaces between the latter (see Figure 2).

As shown in Figs. 5 and 6, the lenses **3**, **31** and **32**, and the concave mirrors **2**, **21**, **22** are arranged in the carrier **18** in such a manner that the latter can be removed upwards from the rest of the system. When this carrier is removed both the prisms and the light source and also the condensing lenses and mirrors are readily accessible for cleaning or adjustment purposes.

The present invention, be it understood, is not limited to the mounting of the light source on the base plate, and could, without substantially modifying the arrangement, be connected to the carrier **18**, for example be removably fitted in said carrier so as to make the light source itself and the inner sides of the lenses and mirrors accessible for cleaning purposes.

Movement of the vehicle, due for example to the car being heavily loaded above the rear axle may in certain circumstances cause the upper boundary of the cone of light, to be raised so much that oncoming users of the road may be dazzled. Also when the car is travelling over undulated country and is for example on a rise, the cone of light is raised so high that dazzling may occur, whilst on the other hand when the car is travelling in a dip too short a stretch may be illuminated in some circumstances.

It is particularly advantageous for the baffle to be operable from the driver's seat, since, as the upper boundary of the beam can be observed very exactly, the driver is able to take care that this upper boundary is always below the eye-level of the drivers of oncoming vehicles, the upper boundary being preferably so adjusted, for the sake of simplicity, that it lies below the head-lights of the oncoming vehicles. Similarly when travelling over hills the upper boundary of the beam can be kept to the summit of the hill so as to avoid dazzling of oncoming drivers by light passing beyond the summit, and when travelling down slopes the beam can be elevated to such an amount as to illuminate a sufficiently long stretch in front.

This adjustment of the upper boundary of the beam is quite sufficient to prevent any dazzle whatsoever, so that the necessity for anti-dazzle screening is eliminated entirely.

Especial attention must also be given to ensure that the upper limit of the beam is under the eye-level of oncoming drivers on the side nearer to the oncoming drivers, that is to say on the left hand side in Germany and other countries where drivers keep to the right of the road. Owing to the curvature or camber of the road however the beam is sometimes raised too high on this side due to the oblique position of the car.

In order to prevent this occurrence, according to a further feature of the invention, the upper boundary of the beam may be made not horizontal but sloping somewhat downwards to the left. This may be achieved either by turning or tilting the condenser system and at the same time turning the divided head-light lens, or by providing in front of the condenser system in the focal plane of the projection lens a baffle which shields the condenser system in such a way that the left-hand corner of the rectangular area of the "distant" beam is cut off.

Fig. 7 is a front view of the baffle arranged in front of the condenser system for production of the "remote" beam and corresponding to the baffle shown in Figure 3. The inclined baffle **11** cuts off a corner of the luminous area formed by the condenser system, and thus the upper left-hand corner of the head-light beam is removed.

In the foregoing description of the screen or baffle **11**, it has been assumed that the car in question is destined for use in a country where drivers take the righthand side of the road. It is obvious, however, that in countries where drivers take the left-hand side of the road, the arrangement described must be reversed and the upper right-hand corner of the cone of light cut off. The baffle may therefore be so arranged that it is reversible without difficulty so as to permit adjustment when crossing the border between two countries.

If with the arrangement described hereinbefore the dimensions are adopted which have been found by experiment to be especially suitable, that is a ratio between the focal length and the diameter at the lens **7** of 5:1, it is not always easy or convenient to arrange the system in a closed casing. I shall therefore proceed to describe two embodiments of the lamp according to this invention constructed as disclosed in the foregoing description and in which this problem is solved in a particularly advantageous fashion. This first possibility consists in arranging the front lens in a corresponding aperture at the side of the radiator or a suitably formed part of the car bonnet, and arranging the condenser system, constructed in the manner previously described, directly in the dashboard so that the beam passes under the bonnet from the light source to the front lens. With this embodiment, which is illustrated in Fig. 8, it is also possible to make the angle of inclination of the beam displaceable relative to the axis of the car. For this purpose the condenser system **3**, **31**, **32** and the light source **1** are mounted on a base plate **40** joined to a part-

spherical disc 41 which slides on a similarly curved surface 42 that may be attached to the back of the dash-board. If the sliding surface 41 is so constructed that its centre of curvature coincides with the centre of the front lens 7 it is possible to lower the beam of the head-light by moving the condenser system upwards.

As indicated diagrammatically in Fig. 8, the condenser system may be shifted from the driver's seat electromagnetically by means of a rod mechanism 43, a ratchet wheel 44 and two pawls 45, 46 moved by the iron cores 47 and the coils 48. These coils can be switched on by pedals 49, each depression of a pedal causing the ratchet wheel to be rotated by the distance of one tooth and thus raising or lowering the head-light beam on step. Obviously, different ways of operating the moving mechanism are possible; for instance the rods may be moved by Bowden cable or by direct manual operation. It is also obvious that by virtue of the co-operating ball and ball-cup arrangement 41, 42 shown in Figure 8, the condenser system can be moved in a horizontal as well as in a vertical direction.

The objective lens 7 is made in two parts as shown and described in connection with Figure 1.

To simplify as much as possible the adjustment of the head-light beam, or the baffles, so that the driver can attend to this operation without his attention being taken off his driving, the preferred construction is, as illustrated in Figure 8, such that the movement of adjustment takes place in a plurality of successive steps effected by the hand knob or pedal, so that the driver can elevate or depress the beam by one step, when he notices that the latter is too low or too high by pressing on the knob or operating the pedal, without having to give his attention to observe how much he must elevate or depress the beam or the upper boundary thereof. Should he then notice that this single operation of the switch is not enough, he operates it a second time and if necessary a third time. This step-by-step adjustment may of course also be applied to the lateral movement of the beam or of the lateral baffles.

What I claim is:

1. An automobile head light comprising a light source, a condenser system comprising a plurality of lenses of short focal length surrounding said light source crown-wise, reflecting surfaces adapted to deflect in the same direction the pencils of light issuing from said condenser lenses, a baffle in front of said condenser system having an aperture for each pencil of light, the width of each of said apertures being equal to the width of the space between two adjacent apertures, and a lense of great focal length made up of two parts each adapted to give a clearly-defined image of said baffle, the centres of said lens parts being spaced apart by a distance equal to the width of one of said apertures.

2. An automobile head light comprising a light source, a condenser system comprising a plurality of lenses of short focal length surrounding said light source, total-reflecting prisms adapted to deflect in the same direction the pencils of light issuing from said condenser lenses, spherical mirrors behind said light source adapted to reflect back the light falling thereon, a carrier to which the light source and said prisms are attached, a further carrier to which said condenser lenses and spherical mirrors are attached and adapted to be fitted into said first-named carrier, a baffle in front of said condenser system, and a lens of great focal length adapted to give a clearly-defined image of said baffle.

3. An automobile head light comprising a light source, a condenser system comprising a plurality of lenses of short focal length surrounding said light source, total-reflecting prisms adapted to deflect in the same direction the pencils of light issuing from said condenser lenses, spherical mirrors behind said light source and adapted to reflect back the light falling on them, a carrier to which said light source and said prisms are attached, a further carrier to which said condenser lenses and spherical mirrors are attached and adapted to be fitted into said first-named carrier, a baffle in front of said condenser system and said prisms, said baffle having an aperture for each pencil of light, the width of each of said apertures being equal to the width of the space between two adjacent apertures, and a lense made up of two long-focus lens parts adapted to give a sharply-defined image of said baffle, the centres of these lens parts being displaced from one another by a distance equal to the width of one of said apertures.

4. An automobile head light comprising a source of light, a condenser system comprising a plurality of short-focus lenses surrounding said light source crown-wise, reflecting surfaces adapted to deflect in the same direction the pencils of light issuing from said condenser lenses, a baffle in front of said condenser system, and two long-focus lens parts adapted each to give a sharp image of said baffle, the centres of these lens parts being spaced apart such a distance that the two images of the baffle form an unbroken bright area, and said baffle being obliquely arranged so that the upper corner of said bright area nearest to the middle of the road is cut off.

5. In automobiles, a bonnet, a head light comprising a light source, a condenser system comprising a plurality of short-focus lenses surrounding the light source, total-reflecting prisms adapted to deflect in the same direction the pencils of light issuing from the condenser lenses, spherical mirrors behind said light source adapted to reflect back the light falling on them, a carrier to which the light source and said prisms are attached, a further carrier to which said condenser lenses and spherical mirrors are attached and adapted to be slidden in said first-mentioned carrier, a baffle in front of said condenser system, said carriers and said baffle being disposed beneath the bonnet, and a long-focus lens being arranged in the front wall of said bonnet and adapted to give a sharply defined image of said baffle.

6. In automobiles, a bonnet, a head light comprising a light source, a condenser system comprising a plurality of short-focus lenses surrounding the light source, total-reflecting prisms adapted to deflect in the same direction the pencils of light issuing from said condenser lenses, spherical mirrors behind the light source adapted to reflect back the light falling on them, a carrier to which the light source and said prisms are attached, a further carrier to which said condenser lenses and spherical mirrors are attached and adapted to be fitted in said first-named carrier, a baffle in front of said condenser system and said prisms and having an aperture for each pencil of light, the width of each of said apertures being equal to the width of the space be-

tween two adjacent apertures, said carriers and said baffle being disposed beneath the bonnet, and an objective lens being arranged in the front wall of the bonnet, said lens comprising two long-focus lens parts adapted to give a sharply defined image of said baffle, the centres of these lens parts being spaced apart by a distance equal to the width of one of said apertures.

7. In automobiles, an engine bonnet, a head light comprising a light source, a condenser system comprising a plurality of short-focus lenses surrounding said light source, total-reflecting prisms adapted to deflect in the same direction the pencils of light issuing from the condenser lenses, spherical mirrors behind the light source adapted to reflect back the light falling thereon, a carrier to which said light source and prisms are attached, a further carrier to which said condenser lenses and spherical mirrors are attached and which is adapted to be fitted in said first-named carrier, a baffle in front of said condenser system and total-reflecting prisms and having an aperture for each pencil of light, the width of each of said apertures being equal to the width of the space between two adjacent apertures, said carriers and baffle being displaceably arranged beneath the bonnet, and an objective lens being arranged in the front wall of the bonnet, said lens comprising two long-focus lens parts adapted each to give a sharply defined image of said baffle, the centres of these lens parts being spaced apart by a distance equal to the width of one of said apertures.

8. A head light comprising a light source, a condenser system comprising a plurality of short-focus lenses surrounding the light source, total-reflecting prisms adapted to deflect in the same direction the pencils of light issuing from said condenser lenses, spherical mirrors behind the light source adapted to reflect back the light falling on them, a carrier to which the light source and said prisms are attached, a further carrier to which said condenser lenses and spherical mirrors are attached and adapted to be fitted in said first-named carrier, a baffle in front of said condenser system and said prisms and having an aperture for each pencil of light, the width of each of said apertures being equal to the width of the space between two adjacent apertures, and lens means of great focal length adapted to give a clearly defined image of the baffle.

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