

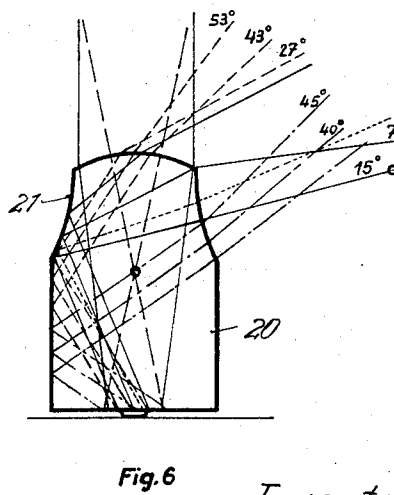
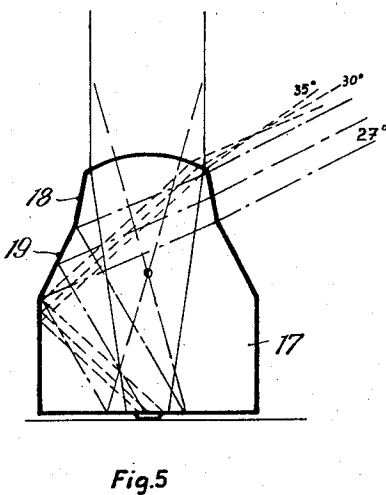
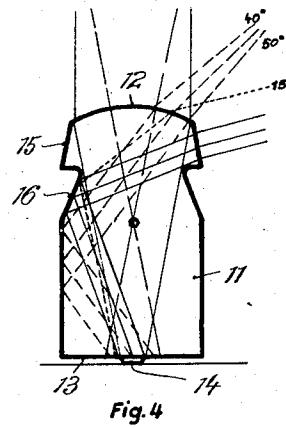
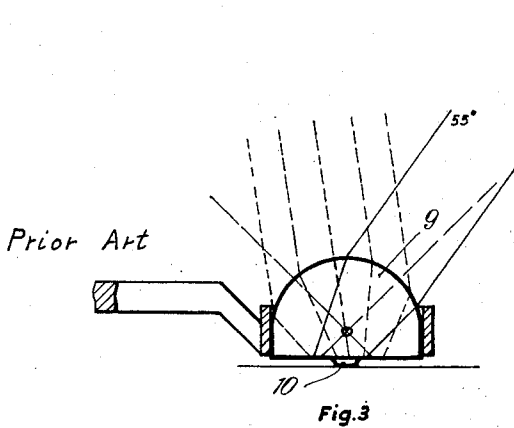
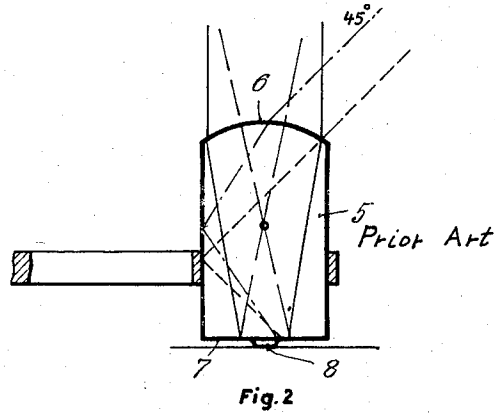
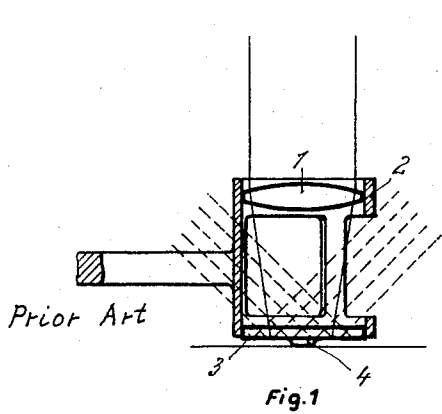
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FOLLOWER MAGNIFIER FOR PLANIMETERS OR SIMILAR INSTRUMENTS

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FOLLOWER MAGNIFIER FOR PLANIMETERS OR SIMILAR INSTRUMENTS

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6 Claims. (Cl. 88—39)

The invention relates to rod magnifiers for planimeters or other mathematical instruments for following the contours of figures as integrators, integragraphs, harmonical analysators, pantographs etc. in which it is essential, to follow the contours of a given figure with the maximum possible accuracy.

As guide organ for following said contours a pointed steel pin has generally been used up to now. In improved instruments follower marks in the form of a small circle or point have been used recently which are e.g. engraved at the lower side of a glass or gem surface and which are enlarged optically by means of a magnifier arranged above it. These known follower magnifiers have, however, different drawbacks which make the exact following of the figures difficult or which are so disturbing under certain circumstances that a regular work is no longer possible with those instruments.

It is a purpose of the present invention to eliminate these drawbacks of the known magnifiers for following the contours and to provide a considerably improved magnifier of this kind.

Other and further objects, features and advantages of the invention will be pointed out hereinafter and appear in the appended claims forming a part of the application. In the drawing

Figs. 1, 2 and 3 are side elevations partly in section showing three known embodiments of magnifiers for following the contours of figures with schematically indicated traces of the rays, and

Figs. 4, 5 and 6 are side views of three different embodiments of magnifiers according to the invention.

In the known embodiment according to Fig. 1 a lenticular magnifier 1 is mounted in a laterally perforated support 2 above a plate 3 at the lower surface of which a follower mark 4 is arranged. It cannot be avoided hereby that shadows are formed in the visual field by the supports of the magnifier and the guiding hand. Particularly in artificial light this formation of shadows is so pronounced that an exact work with the instrument is not possible.

The further known embodiment according to Fig. 2 uses a cylindrical rod magnifier 5 with an upper spherical surface 6 and a lower flat surface 7 at which the mark 8 for following the figures is provided. In this embodiment of the rod magnifier the light enters principally in an inclined angle of 45°–90° through the upper spherical surface 6 of the magnifier.

Through the outer surface of the magnifier no light enters which could reach in an effective manner the surface of the visual field. At a normal work place at a distance of 2 meters from the window the light enters at an angle of 10° to 45° to the plane of the drawing. Therefore, in such a cylindrical rod magnifier the visual field is sufficiently bright only in case of certain favorable conditions of light while with increasing distances from the windows, as this is very often the case, that is in the rooms of polytechnic academies the light is unequal and generally too dark for an exact observation.

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A third known embodiment represented in Fig. 3 uses a hemispherical magnifier 9 with a low cylinder base at the basic surface of which the follower mark 10 is arranged. In this embodiment mainly the light entering at an angle of 55°–90° is active. There is no reaction whatsoever towards lateral light in this form of a magnifier.

The main difference of the inventive idea lies in the fact that within the upper half of the magnifier, which in general is essentially cylindrical, at least two conical surfaces superimposed to each other are provided, the taper angles of which are arranged in such a way to each other that the light beams entering through the upper conical surface respectively surfaces are projected by the lower conical face or faces by preferably total reflection on the visual field of the magnifier.

Practically the invention can be considered in a different manner. In general the superimposed conical surfaces are arranged in such a way that they taper towards the top, that is towards the lens surface of the magnifier. The lower surface of the cone respectively its surfaces taper preferably more than the upper surface or surfaces of the cone.

According to a preferred embodiment of the invention, the rod magnifier has in its upper half, conical recesses whereby a conical surface arranged below the surface of the lens projects the light entering with an angle of incidence between 0° and 45° on an annular recess tapering conically towards the top, from where the light beams are reflected on the visual field of the magnifier. Instead of being recessed, the under conical surface may project as compared with the upper conical surface. The recesses or inclined surfaces need not necessarily be arranged in the form of conical surfaces separated sharply from each other, but the surfaces may be limited by lines curved in any manner, that is they may be formed of an infinite number of small conical surfaces passing into each other.

Fig. 4 shows the particularly advantageous embodiment of the invention already mentioned in the foregoing. It consists of an essentially cylindrical rod magnifier 11 with an upper lens surface 12 and a lower surface 13 bearing a follower mark 14, that is in form of a small gem plate or the like. Below the lens surface 12 a conical surface 15 is provided tapering towards the top and underneath it there is a conical recess 16 tapering more towards the top than the upper conical surface 15. Through the upper lens surface 12 all light beams with an angle of incidence between 40° and 90° enter in such a way that they hit the visual field of the magnifier either directly or after a corresponding reflection by the lower cylindrical part of the rod magnifier. This corresponds to the effect of the known rod magnifier according to Fig. 2. Besides of these rays the upper conical marginal surface 15 collects the lateral rays with angles of incidence between 10° and 40° in such a way that by one total reflection on the inner side of the conical recess 16, which is effective as an annular mirror, said rays are projected on the visual field of the magnifier.

By this means the brightness of the magnifier is surprisingly high and very uniform in all light conditions and this is particularly the case in very high and broad work rooms as e.g. in polytechnical academies with illumination from one side or with generally dull day-light. Even with artificial light a magnifier according to the invention permits a very good illumination of the visual field, independent of the changing positions of the instruments for following the contours, that is by placing a standard desk lamp on the work table. Hereby the further advantage is obtained that disturbing reflections at the surface of the lens are avoided. The accuracy of work of the planimeter or other similar instrument is

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assured in this way, also with conditions of illumination in which a good work with such follower magnifiers was no longer possible.

The importance of the effect obtained by the arrangement according to the invention is, moreover, proved by photometrical measurements under many different conditions of rooms and illumination which have shown that the daylight entering at an angle of incidence between 0° to 45° may be taken into consideration with a light value of 100%, while the light entering at a steep angle of 60° is effective at about 85%, at an angle of 75° with about 70% and with an incidence angle of 90° only with 50%.

Fig. 5 shows an embodiment in which the rod magnifier 17 also has an upper conical surface 18 similar to the conical surface 15 of Fig. 4. The lower conical surface 19 is not recessed as in Fig. 4 but projects towards the exterior, the cylindrical surface of the rod magnifier enlarging correspondingly. The effect of this magnifier corresponds besides to that of Fig. 4.

Fig. 6 shows a rod magnifier 20 with a curved diminishing lateral surface 21, diminishing in the lower part more than in the upper part. This lateral surface may be considered as having been derived from the magnifier according to Fig. 5 in which a great number of narrow conical surfaces with corresponding taper angles are arranged one above the other in such a way that a curved limit line of the marginal surface without any transition is obtained.

According to the further embodiment the magnifier is suitably made of a suitable plastic material. This has the considerable advantage that the magnifier may be made by turning from one single piece whereby the manufacture becomes considerably cheaper than with glass.

The invention is, however, not limited to the embodiments described and illustrated in the accompanying drawings, but is intended to cover all changes and modifications as fall within the scope of the inventive idea.

What I claim is:

1. A tracing magnifier for instruments such as planimeters, integragraphs, pantographs and the like comprising a cylindrical body of transparent light-refracting material adapted to rest on the surface containing the representations to be traced, the upper end of said cylindrical body forming a convex lens face and the lower end of said cylindrical body forming a substantially plane face of a plane-convex lens, the axis of said lens coinciding with the axis of said cylindrical body, said body having a first-tapered circumferential face adjacent to and below the said upper convex lens face and a second-tapered circum-

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ferential face adjacent to and below the said first-tapered circumferential face and a cylindrical circumferential face between said second-tapered circumferential face and said lower end of said body, the two tapered faces tapering towards the upper convex lens face of said body and the angle of taper of the first-tapered circumferential face being smaller than the angle of taper of the second-tapered circumferential face, the tapering angles of said tapered faces being such that lateral light passing through said first-tapered face is reflected by internal reflection by said second-tapered face towards the said lower end face of said body.

2. A tracing magnifier for instruments such as planimeters, integragraphs, pantographs and the like comprising a cylindrical body of transparent light-refracting material adapted to rest on the surface containing the representations to be traced, the upper end of said cylindrical body forming a convex lens face and the lower end of said cylindrical body forming a substantially plane face, a frusto-conical surface adjacent the convex face, and a second frusto-conical surface adjacent and below the first-mentioned frusto-conical surface and merging into the cylindrical body, said frusto-conical surfaces each tapering toward their upper edges with the greater diameter at the bottom edge of each frusto-conical surface.

3. A tracing magnifier according to claim 1, in which the forms of the surfaces of the two tapered faces are generated by rotating at least one curved line about the axis of the cylindrical body.

4. A tracing magnifier according to claim 1, in which the second-mentioned tapered face is recessed.

5. A tracing magnifier according to claim 1, in which the first-mentioned tapered face and the second-mentioned tapered face have a common edge.

6. A tracing magnifier according to claim 1, in which the surfaces of the tapered faces merge into each other to form a curved face.

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