

- [54] **DIGITAL INDICATING DEVICE**
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[22] Filed: **Apr. 12, 1972**
[21] Appl. No.: **243,203**

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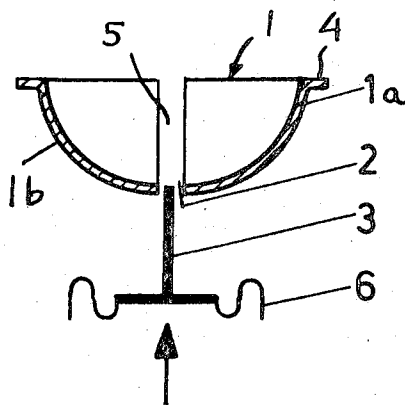
- [30] **Foreign Application Priority Data**
Apr. 16, 1971 Switzerland..... 5543/71
[52] **U.S. Cl.**..... **350/285, 350/293, 250/77,**
40/106.51
[51] **Int. Cl.**..... **G02f 1/34**
[58] **Field of Search** 350/6, 7, 97, 285,
350/293, 301, 266; 240/44.2; 40/106.51; 250/77

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[57] **ABSTRACT**

A reflecting element has at least one curved surface having a first plane of symmetry and being operative for reflecting incident light. A varying element is provided for varying the character of the reflector light and has a second symmetry paralleling the first plane. The elements are relatively moveable between an operative position and an inoperative position in which the varying element respectively varies and does not vary the character of light reflected by the reflecting element. An arrangement is provided for effecting such relative movement of the elements.

15 Claims, 7 Drawing Figures



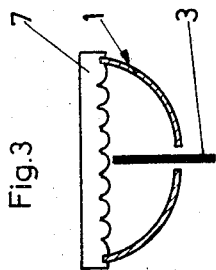


Fig. 2

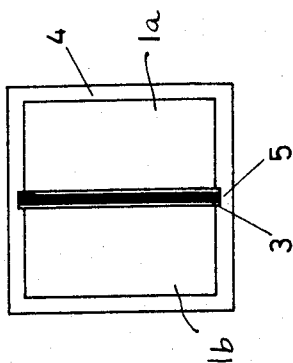


Fig. 1

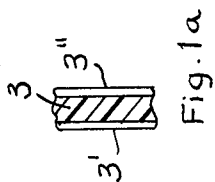
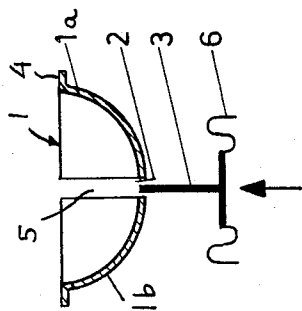


Fig. 4

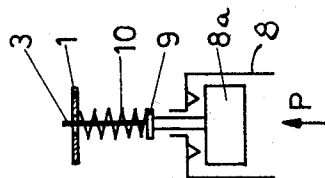


Fig. 5

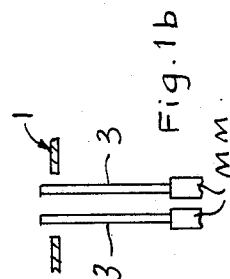
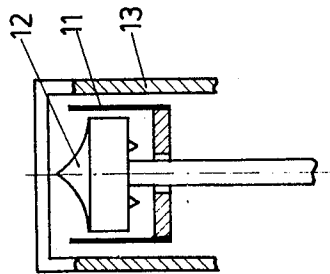


Fig. 1b

DIGITAL INDICATING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates generally to an indicator device, and more particularly to a digital indicator device.

Indicator devices of the general type here under discussion are already known, their purpose being to provide an indication by changing the character of reflected light. In one prior-art construction there is provided a light-reflecting element which is configured as a rod-shaped member having a free end which is rounded and with this rod-shaped member being mounted in the symmetry axis of a reflector whose reflecting surface is configured as a symmetrical surface of rotation. Depending upon the binary condition to be indicated by the device, the rod-shaped member is pushed into the effective reflecting region of the reflector, or withdrawn therefrom.

The entire surface of the rod-shaped member, including its rounded end face, is provided with a reflecting or phosphorizing coating. This means that if the rod-shaped member is withdrawn to what should normally be an inoperative position in which it does not cooperate with the reflector and thus does not vary the character of light reflected by the latter, the coated free end face of the rod-shaped member continues under all circumstances to be visible when the device is viewed. This is a significant disadvantage because it introduces a condition of uncertainty as to whether a signal is being indicated by varying of the light reflected by the reflector, or not. The difficulty results from the fact that even if a signal to be indicated does not exist, a hasty glance of a viewer or disadvantageous ambient lighting conditions may lead—due to the continuing visibility of the free end face of the rod-shaped member—to the assumption that such a signal is actually being indicated.

In addition, this prior-art device has the disadvantage that the viewing side of the device, where the character of the reflected light is viewed to obtain information as to whether or not the device indicates the presence or absence of a signal, can only be of circular configuration due to the fact that both the rod-shaped member and the reflector are of circular cross-section.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the present invention to provide a device of the character here under discussion which avoids the disadvantages of the prior art.

More particularly it is an object of the invention to provide such a device which will afford a reliable and non-ambiguous indication under all circumstances.

Another object of the invention is to provide such a device in which the viewing side can be of other-than-circular outline.

In pursuance of these objects, and of others which will become apparent hereafter, one feature of the invention resides, in a device of the character described, particularly in a digital indicator, which briefly stated comprises a reflecting element provided with at least one curved surface and having a first plane of symmetry and being operative for reflecting incident light. A varying element is provided for varying the character of light reflected by the reflecting element and has a second plane of symmetry paralleling the first plane.

The elements are relatively movable between at least one operative position and an inoperative position in which the varying element respectively varies and does not vary the character of light reflected by the reflecting element. Moving means is provided for effecting relative movement of the elements between the aforementioned positions thereof.

The varying element may have planar or curved surfaces, and its projection onto the viewing plane should at least approach zero. The reflecting element, on the other hand, has a curved or spherical surface whose axis of symmetry is in parallel with the plane or axis of symmetry of the varying element itself. By resorting to this construction no light-reflecting surface portion of the varying element remains visible when a signal is not being indicated. This prevents to all intents and purposes a mistaken reading of an indication provided by the device according to the present invention. Moreover, the device can have a read-out side or viewing side which is of non-circular outline, for instance quadratic or rectangular as is desirable in many applications.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a somewhat diagrammatic view in a vertical section, illustrating one embodiment of the invention;

FIG. 1a is a fragmentary detail view illustrating a further embodiment;

FIG. 1b is a fragmentary detail view illustrating another embodiment of the invention;

FIG. 2 is a top-plan view of FIG. 1;

FIG. 3 is a view similar to FIG. 1 but illustrating a further embodiment of the invention, and with certain parts omitted for the sake of clarity;

FIG. 4 is a diagrammatic side-elevation view, partly in section, illustrating a moving arrangement for effecting movement of the movable element; and

FIG. 5 is a view analogous to FIG. 1 but illustrating an additional embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing firstly the embodiment in FIGS. 1 and 2 it will be seen that reference numeral 1 designates a reflecting element which in the particular embodiment illustrated has two part-cylindrical reflecting surface portions 1a and 1b which are separated by an axially extending slot, and whose cylinder axis extend in parallelism but are transversely spaced from one another. A varying element 3 in form of a plate, strip or the like which is flat and planar and which can be moved up-and-down in the slot 2 as indicated by the arrow in FIG. 1. At opposite axial ends of the slot 2 the element 3 is guided in guide slots 5 provided for this purpose in a lateral frame portion 4 which bounds the reflector 1 and is illustrated only diagrammatically.

It should be noted that the plane of symmetry of the element 3 is normal to the viewing plane of the device which is identical with the plane of the drawing in the

illustration of FIG. 2. In other words, to view an indication provided by the element one would normally look downwardly onto the device as in FIG. 2.

The element 3 is moved from the illustrated inoperative position of FIG. 1 in upward direction (see the arrow of FIG. 1) to provide an indication, that is to vary the character of light reflected by the surface portions 1a and 1b, and for this purpose there is provided in the embodiment of FIGS. 1 and 2 a bellows member 6 which flexes upwardly when pressure is exerted from below and permits the element 3 to move upwardly in the slot 2. Of course, other means can also be provided for this purpose, such as pneumatic cylinders, hydraulic cylinders, electromagnetic means or the like. The member 6 may for instance be made of spring steel or the like and will inherently tend to restore the element 3 to the position shown in FIG. 1 when upward pressure on the member 6 is relaxed.

The side or lateral surfaces of the element 3 may be coated with a strongly light-reflecting paint or the like, for instance a phosphorescent paint, but the entire member 3 may inherently be colored with a phosphorescing or light-reflectant paint so that it is luminous, for instance by being provided in form of a transparent foil or sheet which is tinted with the desired color.

When the element 6 is activated, for instance by subjecting it from below to the action of a suitable pressure fluid, it will effect upward movement of the element 3 in the direction of the arrow in FIG. 1, thereby causing the lateral surfaces of the element 3 to move into the effective region of the reflector 1. If the curvature of the reflector 1 is appropriately selected, which is a matter known to those skilled in the art, the entire viewing plane will then appear to be illuminated with a light which has its character changed by the varying element 3. In other words, light reflected by the reflector 1 may now appear to be tinted the particular color of the element 3, illuminating the viewing plane of the reflector 1 in this color and providing an indication of a signal. Conversely, when the signal which governs the operation of the element 6 disappears, the pressure on the element 6 will also disappear and the latter will flip under its own resilient force back to the position shown in FIG. 1, thereby moving the element 3 to the position which is illustrated in FIG. 1. The entire effective surface of the element 3 thus disappears out of the effective range of the reflector 1, and no residual indicating effect exists as was the case in the aforementioned prior-art construction. It should be noted that the upper edge of the element 3, which is exposed in the slot 2, is not coated with the luminescent paint and, even if the element 3 is inherently tinted to be luminescent, this would not be of any significance because due to its entire withdrawal from the effective region of the reflector 1, insufficient light would enter into the element 3 to be able to cause the color tinting of the latter to provide a modified-light read-out indication in the viewing plane of the device. Thus, it may be said that in the rest position as shown in FIG. 1 the projection of the element 3 into the viewing plane is equal to or approaches zero, meaning that the element 3 in its rest position does not influence at all the appearance of light reflected by the reflector 1, as it is viewed in the viewing plane.

FIG. 1a shows that it is also possible to provide the opposite surfaces of the element 3 with two different

layers 3' and 3'' of luminescent or phosphorescent paint.

FIG. 1b shows that two or more (two shown) of the elements 3 may be provided, which can be each independently moved to operative and rest position by the diagrammatically illustrated moving means MM which again may be of any of the various types mentioned earlier. The elements 3, 3 in FIG. 1b extend in parallelism with one another and it will be appreciated that the surfaces of one of these elements may be coated with one paint and the surfaces of the other with a different paint, or that both of the elements may be tinted, each with a different color. In such a construction selective activation of either or both of the elements 3 provides a further read-out signal condition. For instance, the one element 3 may be tinted or be provided with a coating of red color, and the other element may be provided with a green color.

The reflector 1 may be of metal or synthetic plastic material; in terms of manufacture it is particularly advantageous if it is synthetic plastic material which is mirrored, that is which has metallic material deposited on it in order to provide a mirror reflecting surface. The element 3 may also be of synthetic plastic material, advantageously of a transparent synthetic plastic material which may be tinted with fluorescent or otherwise luminescent paint or dye. Such materials as well as paints and dyes for this purpose are too well known to require detailed discussion and do not in any case form a part of the invention.

The embodiment illustrated in FIG. 3 resembles that of FIG. 1, and certain components have been omitted for the sake of clarity. Like reference numerals designate like elements as in FIG. 1. The embodiment of FIG. 3 differs from that of FIG. 1 in that a more even illumination of the viewing plane is obtained and a better indication by light is achieved, by having a plate or cap member 7 located at or substantially in the viewing plane and provided with grooves, concentric rings, or otherwise light dispersing formations in form of a single or several rasters. Of course, the member 7 must be transparent or at least translucent and it is advantageous if grooves are provided which extend in parallelism with the symmetry plane of the element 3. The member 7 may also be of synthetic plastic material.

The embodiment in FIG. 4 is exemplary of an arrangement for effecting movement of the member 3 between its operative and inoperative positions. In this embodiment there is provided a diagrammatically illustrated cylinder 8 in which a piston 8a is displaceable, being provided with a piston rod which carries an abutment 9. The abutment 9 is located exteriorly of the cylinder 8 and is connected directly with the element 3. An expansion spring 10 bears upon the abutment 9 and on the exterior side of the reflector 1 which is shown only fragmentarily in this Figure. When the piston 8a is moved upwardly under the influence of a suitable pressure force P as indicated by the arrow in FIG. 4, the spring 10 yields and the element 3 moves into the reflector 1. When the pressure P is released, however, the member 3 is withdrawn to the position shown in FIG. 4 by the expansion of the spring 10. It will, however, be appreciated that if for instance the element 6 of FIG. 1 is utilized and is of such type that it will resiliently restore the element 3 to the rest position shown in FIG. 1, the spring 10 may be omitted. Evidently, substantially lower activating forces are required than in FIG.

4 in such a case, to place the member 3 from the rest position into the operative position. If, of course, the member 6 is not self-restoring, then a spring 10 or an analogous means will be needed.

The embodiment in FIG. 5, finally, shows that it is possible to configure the varying element (designated heretofore with reference numeral 3) as a cylindrically configured element 11. Of course, other configurations beside the cylinder configuration can be chosen. It must however, always be kept in mind that the effective surface of the element 11 will be normal with respect to the viewing plane. Putting this differently it can be said that the surface of the element 11 (or 3 in the preceding embodiment) which is projected into the viewing plane must be as small as possible and should preferably approach zero.

In FIG. 5 the reflector is designated with reference numeral 12 and has a reflecting surface which is configured as a surface of rotation, having an axis of symmetry which extends in parallelism with the longitudinal axis of the cylindrical varying element 11. In the illustrated embodiment the two axes are coincident and the element 11 concentrically surrounds the reflector 12. A housing 13 is provided, surrounding the device and being transparent for viewing purposes at least in the region of the viewing plane, as indicated in FIG. 5. It is, however, advantageous if the transparent portion of the housing 13 extends further downwardly than shown so that it is possible to read an indication provided by the device even if the device is viewed under a relatively flat angle.

It will be understood that the element 11, which is movable by any of the previously mentioned means with respect to the element 12, could also be made stationary with the element 12 being mounted so that it can be moved with reference to the element 11. When the reflector 12 would then be raised, that is in the direction towards the viewing plane, the effective surface of the element 11 would become covered to prevent modification of the character of the reflected light, whereas a lowering of the reflector 12 away from the viewing plane would make the effective surface of the element 11 become fully operative.

This reversion of the stationary and movable elements is of course possible in the other embodiments also.

It will be appreciated that a particular advantage of the construction according to the present invention resides in the fact that it requires no active optical components at all, but is based exclusively on the principle of varying the character of incident light, that is light which impinges onto the reflector of the device. This means that the device will automatically accommodate itself to the ambient brightness existing at any given moment. The advantage of this will be appreciated when it is considered that a significant disadvantage of known active indicating devices, that is devices which have active optical components, resides in the fact that the adaptation capability of the human eye is not sufficient in the case of strong fluctuations in the amount of ambient light, to assure a reliable and error-free reading of the indications provided by such devices. This is evidently not to be feared in the construction according to the present invention for the reasons which have just been outlined above.

It will be understood that each of the elements described above, or two or more together, may also find

a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a digital indicating device, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. A device of the character described, particularly a digital indicator, comprising a reflecting element provided with a curved reflecting surface bounding an opening through which incident light is admitted to be reflected by said reflecting surface, said reflecting surface having a first plane of symmetry; a varying element for varying the character of light reflected by said reflecting element and having a second plane of symmetry paralleling said first plane, said elements being relatively movable between at least one operative position and an inoperative position in which said varying element is closer to and farther spaced from said opening and respectively varies and does not vary the character of light admitted through said opening and reflected by said reflecting element; and moving means for effecting relative movement of said elements between said positions thereof.

2. A device as defined in claim 15, said reflecting element having an indicating plane from which it is viewed to determine the character of reflected light; and wherein said varying element is so constructed that its projection onto such indicating plane approaches zero.

3. A device as defined in claim 15, wherein said varying element selectively reflects light.

4. A device as defined in claim 15, wherein said varying element selectively absorbs light.

5. A device as defined in claim 15, said varying element having at least one exposed surface; and further comprising a coating of luminescent material.

6. A device as defined in claim 15, said varying element being luminescent.

7. A device as defined in claim 15, said curved surface comprising two part-cylindrical surface portions having transversely spaced parallel cylinder axes.

8. A device as defined in claim 15, said reflecting element being box-shaped and being of right-angled cross-section in direction normal to the direction of relative movement of said elements.

9. A device as defined in claim 15, said reflecting element having an indicating plane from which it is to be viewed to determine the character of the reflected light; and further comprising a light-diffusing member provided on said reflecting element in the region of said viewing plane.

10. A device as defined in claim 15, wherein said varying element is movable with reference to said reflecting element between said operative and inoperative positions.

11. A device as defined in claim 15; further comprising at least one additional varying element, both of said varying elements being planar and located in parallel planes with freedom of independent movement with reference to said reflecting element; and wherein said moving means is operative for moving said varying elements independently of one another, each between said operative and inoperative positions.

12. A device of the character described, particularly a digital indicator, comprising a reflecting element provided with at least one curved surface configured as a surface of revolution having an axis of symmetry and being operative for reflecting incident light; a varying element for varying the character of light reflected by said reflecting element, said varying element being configured as a cylinder surrounding said reflecting element and having a longitudinal axis coinciding with said axis of symmetry, said cylinder having an open end for viewing and for admission of light, said elements being relatively movable between at least one operative position and an inoperative position in which said varying element respectively varies and does not vary the character of light reflected by said reflecting element; and moving means for effecting relative movement of said elements between said positions thereof.

13. A device as defined in claim 16, wherein said re-

flecting element is movable with reference to said varying element between said operative and inoperative positions, longitudinally of said axis of symmetry.

14. A device as claimed in claim 15, said moving means comprising a resiliently flexible member operatively associated with one of said elements, said member being flexible for enabling movement of said one element to said operative position but inherently biasing said one element to said inoperative position.

15. A device of the character described, particularly a digital indicator, comprising a reflecting element provided with at least one curved surface having a first plane of symmetry and operative for reflecting incident light, the curvature of said surface being such that the intensity of the reflected light is substantially the same in all directions; a varying element for varying the character of light reflected by said reflecting element and having a second plane of symmetry paralleling said first plane, said elements being relatively movable between at least one operative position and an inoperative position in which said varying element respectively varies and does not vary the character of light reflected by said reflecting element; and moving means for effecting relative movement of said elements between said positions thereof.

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