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Yata et al.

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[54] **ELECTRONIC FLASH PARAMETER CALCULATOR DEVICE**

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[73] Assignee: **Minolta Camera Kabushiki Kaisha**, Osaka, Japan

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[51] **Int. Cl.** **G06c 3/00**

[58] **Field of Search** 235/64.7, 88

[56] **References Cited**

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[57] **ABSTRACT**

A flash parameter calculator includes an assembly of an outer knob with a flat face having a transparent half and an opposite half with a medial window, a coaxial inner knob projecting through the outer knob and three superimposed annuli underlying the outer knob, the upper annulus being fixed, the intermediate annulus being rotated by the inner knob and the bottom annulus being independently angularly adjustable. The outer knob transparent half carries circumferentially spaced lens opening designating indicia, the upper annulus carries along one half circumferentially extending first range indicia along one half and film speed rating indicia along the other half, the intermediate annulus is provided with a transparent border extending for part of the circumference, and the bottom annulus carries circumferentially spaced distance designating indicia. The distance indicia is radially spaced from the lens opening indicia which are observable through the outer knob transparent portion and the film speed indicia are viewable through the window, the range indicia delineate limited ranges of the distance and lens opening indicia.

6 Claims, 3 Drawing Figures

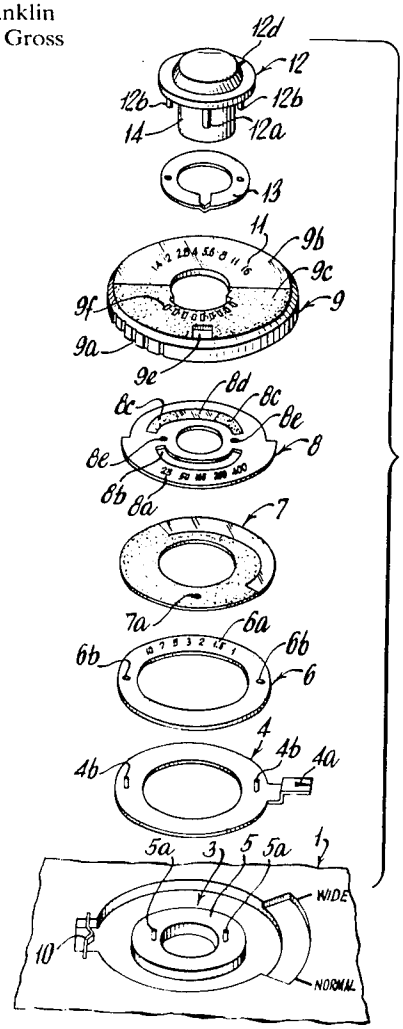


Fig.1.

f \ ASA	25	50	100	200	400
1.4	8	11	16		
2.	5.6	8	11	16	
2.8		5.6	8	11	16
4.			5.6	8	11
5.6				5.6	8
8.					5.6

Fig.2.

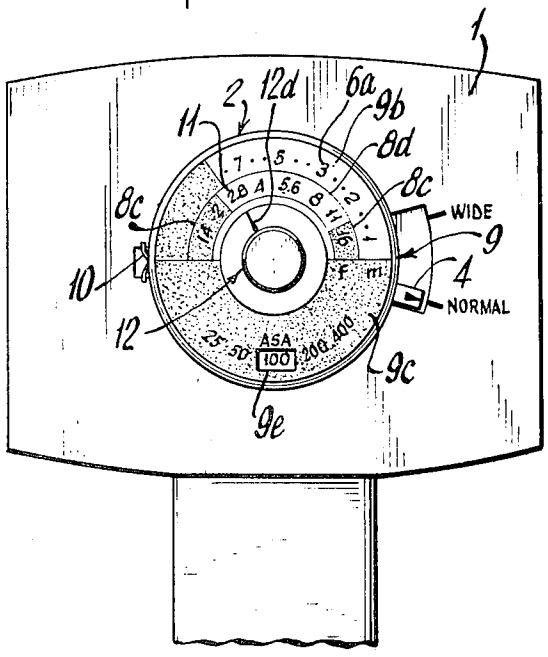
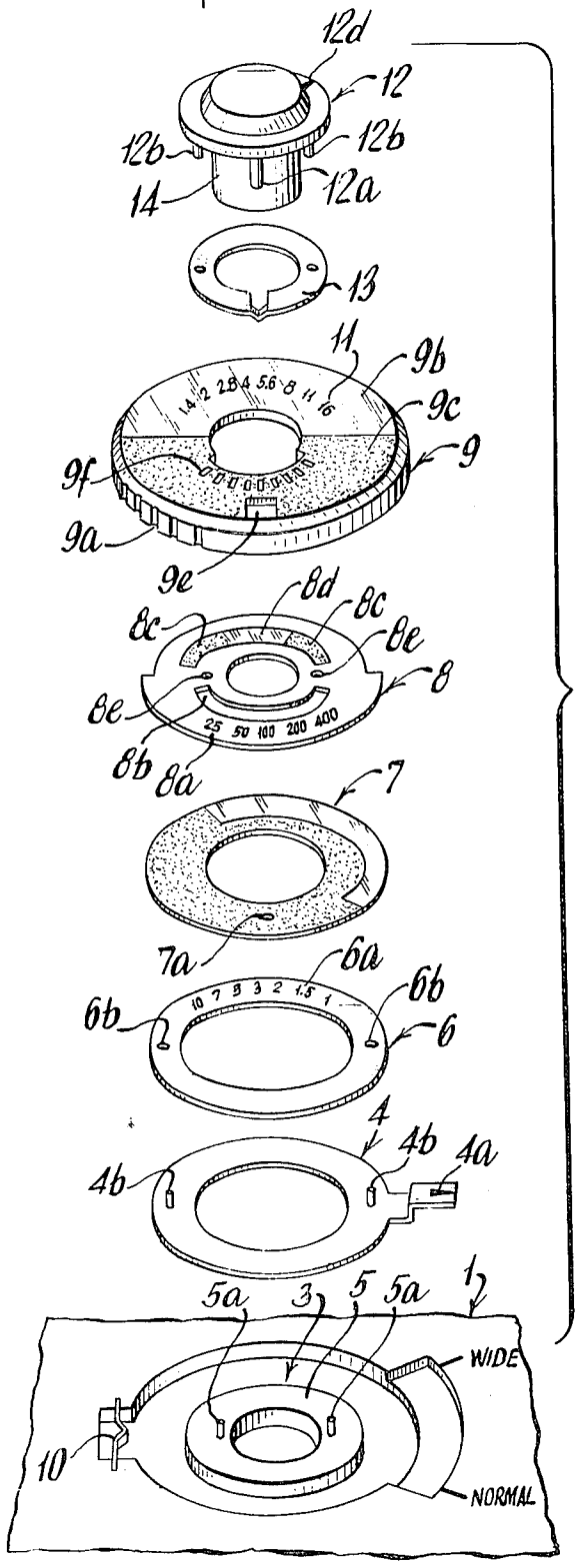


Fig.3.


12d
12
12b
12b
14
12a
13
11
9b
9c
9
9f
9a
9e
1.4 2 2.8 4 5.6 8 11 16
8d
8c
8c
8e
8
8e
8b
8a
25 50 100 200 400
7
7a
6a
6b
6b
6
10 7 5 3 2 1.5 1
4
4b
4a
4b
5a
3
5
5a
1
WIDE
10
NORMAL

ELECTRONIC FLASH PARAMETER CALCULATOR DEVICE

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in calculator devices and it relates more particularly to an improved exposure factor or parameters calculator highly useful with camera electronic flash devices of the automatic light quantity adjusting type.

The conventional construction of the automatic light quantity adjusting type flash device used with a camera is such that the diaphragm aperture value of the photographing lens is maintained constant and the quantity of flash light from the flashing device is regulated according to the distance to the photographic object. However, the occasion often arises when the photographer desires to practice flash-photographing by setting the lens diaphragm aperture value to an arbitrary value, in terms of a constant distance, whereby there is available a greater permissable range of distance at which flash-photographing can be preformed, the better for the photographer. To this end, an automatic light quantity adjusting type flashing device has been proposed, in which the intensity of the light reflected from an object is integrated to a predetermined level, whereby when such level is reached, the flash device network is designed so as to extinguish the flash device. In this respect, the aforesaid predetermined integrated light level for extinguishing the flash lamp may be set to a desired level depending on the diaphragm aperture value of the photographing lens.

With the automatic light quantity adjusting type flashing device which permits the setting of the diaphragm aperture value of the photographing lens to an arbitrary diaphragm value, the range of the distance permitting flash-photography depends on the diaphragm value, such that information is required indicating the range of distance at which the flash-photographing is permitted.

Furthermore, with an automatic light quantity adjusting type flashing device, there arises another need to vary the light quantity for a constant diaphragm value and a constant distance, depending on the sensitivity of a film used.

For the above reasons, a photographer should consider the following parameter or factor in practicing flash-photographing, he should determine beforehand if a photographic object comes within the range of the distance which permits the flash-photography in terms of the desired diaphragm aperture value of the photographing lens and the sensitivity of a film used. The calculator according to the present invention is intended to aid in facilitating the aforesaid consideration for the photographer. Calculators of the above type which have been heretofore proposed possess numerous drawbacks and disadvantages.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide an improved calculator device.

Another object of the present invention is to provide an improved device for calculating and correlating the parameters and factors associated with flash photography.

Still another object of the present invention is to provide an improved calculator for correlating photographic lens aperture value, the photographic object distance and the film speed rating.

A further object of the present invention is to provide an improved calculator which furnishes information relative to the object distance permissable range and the diaphragm aperture value permissable range in flash photography employing a flash device of the automatic type wherein the flash lamp is extinguished in response to a predetermined amount of light being reflected from the object to the camera, and in which the response level is adjustable.

Still a further object of the present invention is to provide a device of the above nature characterized by its reliability, compactness, versatility and ease and convenience of use.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawings which illustrate a preferred embodiment thereof.

In a sense, the present invention contemplates the provision of an improved flash parameter calculator device comprising a first section having distance indicia spaced along a first path, a second section having first range delineating indicia located proximate the distance indicia, a third section having film speed indicia along a second path and second range delineating indicia spaced along a third path and a fourth section having lens diaphragm opening indicia located along a fourth path and an indicator located proximate and movable along the second path, the second and fourth sections being independently movable relative to the first and third sections. In the preferred form of the improved calculator the four sections are coaxial and circular and in superimposed relationship. The four sections are annuli with the indicia circumferentially spaced and the first to fourth sections being successively arranged with the first section undermost and the fourth section being a knob with one half being transparent and carrying the lens opening indicia and a film speed indicia exposing window formed in its other half. The first, second and fourth sections are angularly adjustable and the third section is stationary and a coaxial knob extends from the second section through the third and fourth sections.

The improved calculator device is simple, compact, reliable, highly versatile and adaptable, and easy and convenient to use.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a table showing the relationship between the diaphragm aperture value of the photographing lens, the film speed rating and the permissable distance range for flash photograph for a particular flash unit;

FIG. 2 is a front elevational view of a calculator embodying the present invention; and

FIG. 3 is an exploded perspective view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In considering the function of the present improved calculator, assume the use of a film with a speed rating of ASA 100, the distance limit for flash-photography at a diaphragm value of 1.4 is *l*. This is under conditions of maximum light quantity and hence the flash-photographing distance limit is *l*/2 at a diaphragm aperture value of 2.8 (2×1.4). On the other hand, when the

sensitivity of the film is ASA 200, the limit distance at a diaphragm value of 1.4 is 2*l*, however, this value should be set to *l* for the reason which will be described in detail hereinafter, while the diaphragm aperture value should be set at 2 for the distance limit *l* thus set. FIG. **1** is a table showing the relationship between the film sensitivity, diaphragm value and distance limit which permit satisfactory flash-photography. In this table, *l* is shown as being 16 m. According to the present invention, the data included in this table are reflected in the improved calculator.

Referring now to FIGS. **2** and **3** of the drawings which illustrate a preferred embodiment of the present invention, the reference numeral **1** generally designates a base plate which may be the side wall of a body of a flashing device. The improved calculator is generally shown at **2** and is of rotatable dial construction and includes a dial disc or flat faced knob **9** whose lower half portion is non-transparent and has window opening **9***e* therein, through which a figure denoting ASA sensitivity appears. In use, the dial disc **9** is rotated to indicate a figure of film ASA sensitivity through the opening **9***e*. Provided on the transparent upper half portion **9***b* of the disc **9** along the circumference thereof are FIGS. **11** of diaphragm aperture values the figures being located at equally spaced intervals. Extending along figures **11** but outwardly thereof are FIGS. **6***a* which represent object distances. These FIGS. **6***a* are not printed on the disc **9** but on the disc **6** underneath the disc **9** and are visible through the disc **9.** Disposed under and extending along the diaphragm aperture value figures **11** is a bright color portion **8***d* of arcuate shape, as well as other arcuate portions **8***c* of a dark color or of a color the same as that of the figures **11.** These portions may be printed on base plate **1.**

As a result, the FIGS. **11** are visible, if the bright color portion **8***d* is positioned under the figures **11.** However, if the dark color portion **8***c* is disposed under the figures **11,** then the figures are hard to read. Accordingly, the provision of the bright color and the dark color portions permits the observation of a certain range or group of figures **11,** while shielding the other range of the figures. Referring to FIG. **2,** five figures, 2.8 to 11 are visible. With such an arrangement, if the disc **9** is rotated until a particular film ASA sensitivity rating appears through the opening **9***e*, then there will be indicated a certain range of the diaphragm aperture values. Shown at **12** is a knob having an indicator or pointer **12***d* which is intended to point at a desired figure of the diaphragm aperture values **11** on the disc **9,** by rotating the knob **12.** A partially peripherally cut-away disc **7** is located under the disc **9** and is intended to shield a part and expose a part of the figures **6***a* representing distance, and is integrally rotatable with the knob **12,** such that the cut-away portion of the disc **7** permits viewing a certain range of group of figures **6***a*, while shielding the other range of figures. Alternatively, the cut-away portion may be replaced by a transparent border portion through which the distance indicia **6***a* can be viewed. In the drawing shown, the range of 1 to 8 m is indicated for distance while **8** is not marked but readable from points between FIGS. **6***a*. In this respect, the range shown may be varied by rotating the grip **12.**

In FIG. **2,** a figure 100 representing the film ASA sensitivity is exposed through the window opening **9***e*, and the diaphragm value is shown as being 2.8 which in turn represent a distance limit of the photographing range of 8 m. In this case, when the diaphragm value is set to 4 and the knob **12** is rotated so as to cause the indicator **12***d* to point at 4 among the figures **11,** then the cut-away disc **7** will be rotated integrally with the knob **12** to shield the distance of 8 m and indicate a distance limit of 5.6 m instead. On the other hand, when the disc **9** is rotated in a clockwise direction so as to indicate an ASA sensitivity rating of 50, then a series of figures **11** for diaphragm values on the disc **9** will be shifted by one figure to the right, i.e., the figure of 2 will replace the figure of 2.8. This signifies that a diaphragm value of 2.8 for ASA 100 is equivalent in terms of exposure to a diaphragm value of 2 for ASA **50.**

As seen in FIG. **3,** there is provided an annular channel or recessed portion **3** in the base plate **1,** in which portion nests a ring **4** having a radial arm **4***a*. A pair of pins **4***b* mounted upright on the ring **4** engage holes **6***b* in a ring **6,** while the arm **4***a* extending from the ring **4** is adapted to rotate within a recessed portion extending outwardly from the recessed portion **3,** within a range defined by marks 'Wide' and 'Normal.' The figures **6***a* representing distances are printed on the surface of the ring **6.** According to the previous description of the embodiment shown in FIG. **2,** the figures **6***a* are explained as being printed on the base plate **1.** However, in common practice, the transmission of the flash light from the flashing device is adjustable between a linearly advancing mode and a diffusing mode, such that the distance limit of the photographing range may be varied, depending on the aforesaid selected mode. For this reason, the figures for distance should be shifted to a position along the circumference thereof, depending on whether the direct or linear light radiation or the diffused light radiation is employed. The ring **4** functions to meet this requirement. Located in the center of recessed portion **3** is a coaxial circular, raised portion **5,** which mounts upright pins **5***a* thereon. Superposed on the ring **6** is a cut-away annulus or centrally opened disc **7** which serves to shield unnecessary portions of the distance figures. The disc **7** is also fitted in the recessed portion **3** and has an opening therein, whose diameter is slightly greater than the distance between pins **5***a*.

Superimposed on the disc **7** is an annulus or disc **8,** on which are printed figures **8***a* representing film ASA sensitivity ratings. The disc **8** has a greater diameter half circular portion and a smaller diameter half circular portion, while the figures **8***a* are printed on the surface of the greater diameter portion, with the distance figures on the ring **6** being located radially outwardly of the smaller diameter portion. Provided in the disc **8** are holes **8***e* which engage pins **5***a* mounted upright on the circular portion **5,** whereby the disc **8** is stationarily secured to the base plate **1.**

The smaller diameter portion of the disc **8** is so printed as to present an intermediate bright color arcuate portion **8***d* extending along the circumference of the smaller diameter portion, and the dark color arcuate portions **8***c* are positioned adjacent to and in alignment with but on the opposite sides of the bright color portion **8***d*. The color of the dark color portion may be the same as that of the figures **11** for diaphragm value. A disc **9** is superimposed on the disc **8** and as has been described hereinbefore, the disc **9** has an opaque half portion **9***c*, in which there is provided a window or opening **9***e*, through which one of the figures **8***a* of ASA

sensitivity is visible, and the disc 9 has a transparent half portion 9*b*, on which are printed the figures 11 designating diaphragm aperture values. The figures 11 are so provided as to divide the range from 1.4 to 16 into equally spaced intervals. Furthermore, the angular spacings of the figures 11 for the diaphragm aperture values are the same as those of the figures for ASA sensitivities, such as 25, 50 . . . (in the increments of 2 fold). Grooves 9*a* are provided in the outer circumferential surface of the disc 9 at an angular spacing, the same as that of the FIGS. 11, thereby affording clicks during the rotation of the disc 9 by virtue of an engagement with a detent plate spring 10. Disposed under the figures 11 on the disc 9 are bright and dark color portions 8*a* and 8*d* provided on the surface of the disc 8, such that the figures 11 are not visible, when the dark color portion 8*d* are located under the figures 11, while the figures 11 are readily visible, when the bright color portion 8*c* is under the figures 11. Again, in this respect, the dark color portions may be substituted by the portion having the same color as that of the figures 11. Coaxial with the disc 9 is the knob 12 whose shaft portion 14 extends through discs 8 and 9 into engagement with the central opening of the raised circular portion 5 of the base plate 1, and thus the shaft portion 14 is rotatable therein. A pin 12*a* depends downwardly from the knob 12 and extends through the enlarged diameter portion (front as viewed) of the center opening in the disc 9, then through the circumferentially elongated slot 8*b* provided in the greater diameter portion of the disc 8, and then in engagement with a hole 7*a* in the cut-away disc 7. Thus, when the kknob 12 is rotated, then the cut-away disc 7 will be rotated to indicate the distance limit for photographing. Interposed between the knob 12 and the disc 9 is a spring washer 13, having apertures engaging pins 12*b* depending from the knob 12 thereby effecting the rotation of the washer 13 together with the grip 12. This further causes the depending projecting detent portion on the underside of the washer 13 to engage with a series of grooves 9*f* provided on the circumference of the disc 9, thus affording clicks during the rotation of the knob 12. A pointer or indicator 12*d* is provided on the grip 12 so as to point at any selected of the FIGS. 11 figures diaphragm aperture values on the disc 9.

The reason for this arrangement, in which the range of the figures for diaphragm values to be indicated varies depending on ASA sensitivity is as follows: The automatic light quantity adjusting circuit is so designed as to receive the light from a photographic object to integrate same and to terminate the radiation from the flashing device, when the integrated value reaches a predetermined value. Thus, the set value is varied, commensurate to the diaphragm value of a photographing lens. Suppose that the lower limit of the variable range of the set values is Q. Since the total light quantity from the flashing device is constant, irrespective of the film sensitivity and the diaphragm value, there will result a constant distance, at which the integrated value of the quantity of the light is to be received. This distance is designated as being *l*. It follows that the automatic light quantity adjusting type flashing device fails to adjust the light quantity for an object further than the distance *l*, irrespective of the film sensitivity and diaphragm value. If an object positioned further than this distance is desired to be photographed, then a flash tube of a different guide number should be used instead. Meanwhile, *l* represents the limit of the distance for the automatic light quantity adjusting type flashing device, such that if the distance allows the diaphragm value of 2 for ASA 200, then the diaphragm value for ASA 400 will be 2.8. If an object is photographed at a distance *l* at ASA 400 and at a diaphragm value of 2, then, an excessive exposure results. However, the automatic light quantity adjusting type flashing device is not capable of using a set level below the minimum level Q, such that the flashing device radiates the total quantity of light even at a diaphragm value of 2. Accordingly, the maximum distance controllable is determined by the minimum level which allows the aforesaid set level, and thereby the control of the light quantity is not possible, even if the light quantity is sufficient to photograph a picture of an object positioned further than required. For this reason, the limitation is imposed on the range of the diaphragm values to be set. The blank spaces in the table of FIG. 1 are provided for this purpose.

With such an arrangement, the diaphragm value of a photographing lens, distance of a photographic object and film sensitivity are indicated on a dial, without the need to consider the relationship of the aforesaid three factors. This facilitates the operation of the automatic light quantity adjusting type flashing device which further permits the free selection of the diaphragm value of the photographing lens.

While there has been described and illustrated a preferred embodiment of the present invention, it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit thereof.

We claim:

1. An exposure factor calculator for use in a flashing device for a camera, comprising:

a first disk (8) having a bright colored portion (8*d*), a dark colored portion (8*c*), and film sensitivity graduations (8*a*) provided along a circumference thereof;

a second disk (9) including an indicating portion (9*e*) for indicating one figure of said film sensitivity graduations (8*a*) and being rotatable relative to said first disk to be set in a position where said indicating portion (9*e*) selectively indicates one figure of said film sensitivity graduations (8*a*), said second disk (9) further having diaphragm value graduations (11) for a photographic lens provided along a circumference thereof and having the same color as said dark colored portion of said first disk, said bright colored portion having an extension corresponding to that of a range of said diaphragm value available for the indicated film sensitivity, and being so arranged as to be just positioned under said range and to make figures in said range visible, while said dark colored portion is so arranged as to be positioned under the outside of said range and to make such outside figures invisible;

a third disk (6) having distance graduations (6*a*) along a circumference thereof;

a pointer (12*d*) for indicating one figure of said diaphragm value graduations (11), said pointer (12*d*) being rotatable relative to said second disk to be set in a position where it points at one FIGURE of said diaphragm value graduations (11); and

a fourth disk (7) having a transparent portion and an opaque portion, and being rotatable integrally with said pointer (12*d*) and relative to said third disk

(6); said third disk (6), said fourth disk (7), and said pointer (12*d*) being so arranged that a range of said distance available for said pointed diaphragm value is positioned under said transparent portion of said fourth disk (7) and made visible with the outside of said range shielded by said opaque portion.

2. An exposure factor calculator comprising:

a base structure (1) having projections (5*a*) projecting upwards therefrom;

a first disc (8) having thereon film speed rating indicia (8*a*) spaced along a first predetermined circular path and a first range delineating portion having a bright colored area and a dark colored area and spaced along a second predetermined circular path, said first disc being fixed to said base structure by said projections;

a second disc (9) including a transparent portion (9*b*) having lens diaphragm opening indicia (11) and an opaque portion (9*c*) having a window (9*e*), said second disc (9) being arranged on said first disc (8) coaxially therewith and adapted to be rotatable relative to said first disc (8), said window (9*e*) being located along said first circular path so that one of said film speed rating indicia (8*a*) is visible therethrough, and said lens diaphragm opening indicia (11) having the same color as said dark colored area of said first disc (8) and located along said second circular path so as to be in part visible on said bright colored area with the other part thereof superimposed on said dark colored area;

a third disc (6) having distance indicia (6*a*) provided along a third predetermined circular path and arranged between said first disc (8) and said base structure (1) coaxially with said first disc, said third circular path being radially offset from said first circular path;

an indicating member (12) having an indicating portion (12*d*), said indicating member being arranged on said second disc (9) coaxially with said first disc and adapted to be rotatable relative to said second disc (9) to be set in a position where said indicating portion (12*d*) selectively indicates one of said lens diaphragm opening indicia (11) on said second disc (9), and said indicating member (12) further having a projection (12*a*) projecting downwards therefrom and extending through said first and second discs; and

a fourth disc (7) having a second range delineating portion consisting of a transparent area and an opaque area and arranged between said first disc (8) and said third disc (6) coaxially therewith, said second range delineating portion being located on said third circular path, and said fourth disc being fixed to said indicating member (12) by said projection (12*a*) so as to be integrally rotatable therewith and being adapted to be rotatable relative to said third disc so that a part of said distance indicia is visible through said transparent area of said second range delineating portion and said transparent portion (9*b*) of said second disc (9) with the other part of said distance indicia being shielded by said opaque portion thereof.

3. The calculator of claim 2 wherein said third disc (6) is independently rotatable relative to said first, second and fourth discs and said indicating member so that the visible part of said distance indicia varies in response to the rotation thereof.

4. The calculator of claim 3 further comprising a fifth disc arranged between said fourth disc and said base structure coaxially with said first to fourth discs and said indicating member is manually rotatable, said fifth disc being fixed to said third disc with projections upwards projecting therefrom so that the rotation thereof causes said third disc to rotate relative to said first, second and third discs and said indicating member.

5. An exposure factor calculator comprising:

a first circular member (8) having thereon film speed rating indicia (8*a*) spaced along a first predetermined circular path and a first range delineating portion (8*c*) spaced along a second predetermined circular path, said first and second circular paths being radially offset from each other;

a second circular member (9) having a transparent portion (9*b*), a first indicator (9*e*) and lens diaphragm opening indicia (11), said second circular member (9) being coaxially supported with said first circular member (8) and being rotatable relative to said first circular member (8) to be set in a position where said first indicator (9*e*) selectively indicates one of said film speed rating indicia (8*a*), said lens diaphragm opening indicia (11) lying along said second circular path so as to be visible in part and delineated by said first delineating portion (8*c*) of said first circular member (8);

a third circular member (6) coaxially supported with said first and second circular members and having thereon distance designating indicia (6*a*) spaced along a third predetermined circular path, said third circular path being radially offset from said first and second circular paths;

an indicating member (12) having a second indicator (12*d*), said indicating member (12) being coaxially supported with said first to third circular members and rotatable relative to said second circular member (9) to be set in a position where said second indicator (12*d*) selectively indicates one of said lens diaphragm opening indicia (11); and

a fourth circular member (7) coaxially supported with said first to third circular membvers and said indicating member and being rotatable integrally with said indicating member and relative to said third circular member, said fourth circular member having a second range delineating portion defined by a transparent border and lying along said third circular path, said distance indicia (6*a*) being visible in part through said transparent border of said second range delineating portion of said fourth circular member (7) and said transparent portion of said second circular member (9).

6. The exposure calculator of claim 5 wherein said third circular member is arranged to be independently rotatable relative to said first, second and fourth circular members and said indicating member.

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