Jan. 15, 1963 H. P. ROGANTI 3,073,234

MINIATURE REFLEX COPY-REPRODUCING DEVICE

Filed July 25, 1960 3 Sheets-Sheet 1

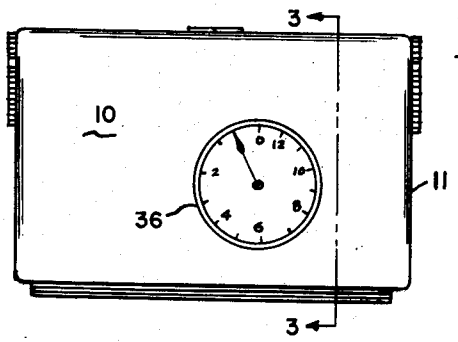


Fig-1

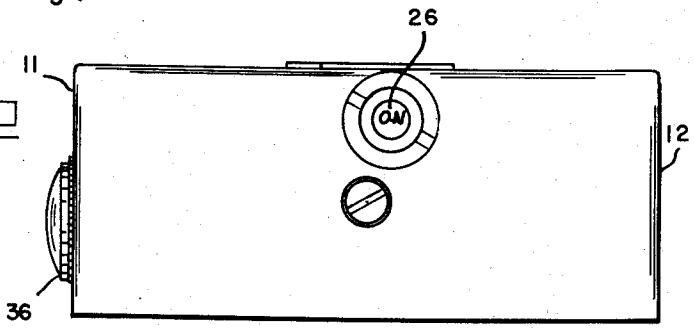
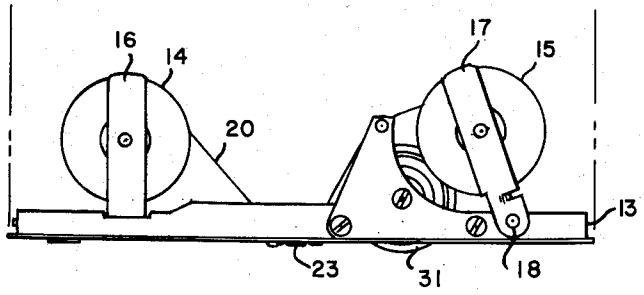


Fig-2



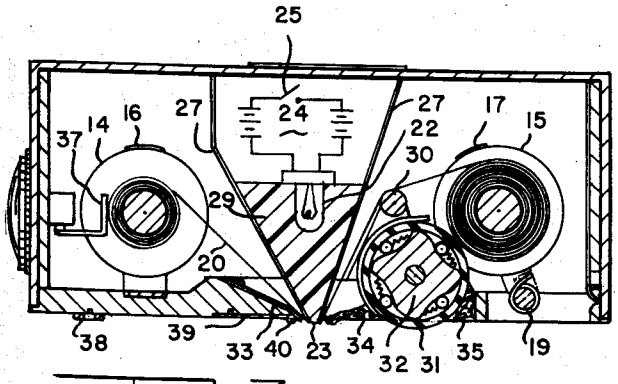


Fig-3

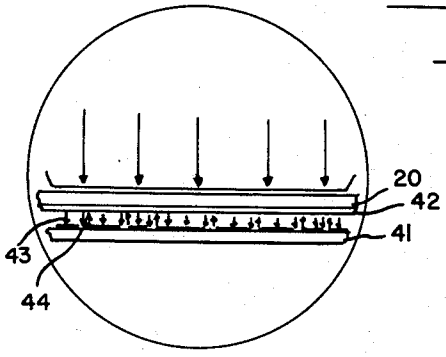
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Jan. 15, 1963 H. P. ROGANTI 3,073,234

MINIATURE REFLEX COPY-REPRODUCING DEVICE

Filed July 25, 1960 3 Sheets-Sheet 2

Fig-4



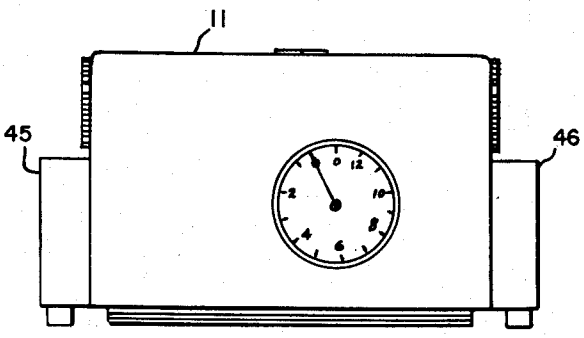


Fig-5

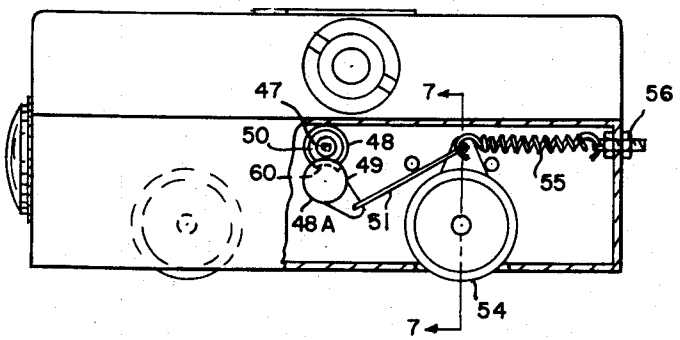


Fig-6

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MINIATURE REFLEX COPY-REPRODUCING DEVICE

Filed July 25, 1960 3 Sheets-Sheet 3

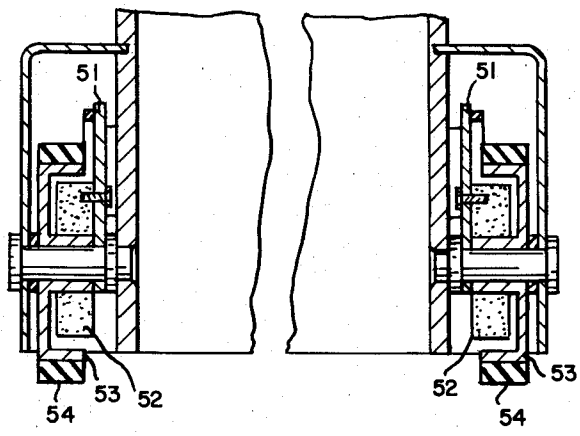


Fig-7

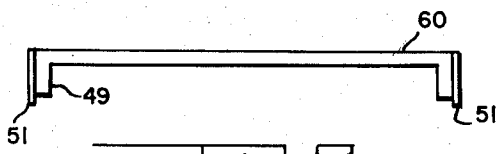


Fig-8

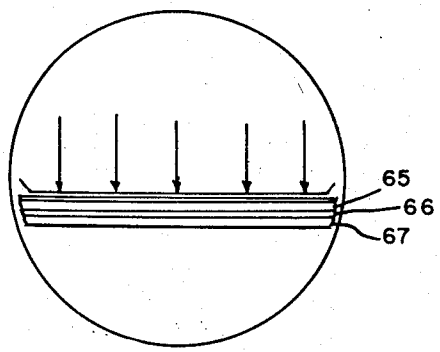


Fig-9

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3,073,234

MINIATURE REFLEX COPY-REPRODUCING DEVICE

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Filed July 25, 1960, Ser. No. 45,248
14 Claims. (Cl. 95—75)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a miniature reflex copy-reproducing device.

One object of the invention is to provide a copy-reproducing device which is capable of producing copies without having to remove pages from bound documents.

Another object is to provide a copy-reproducing device which is compact and easy to operate.

These and other objects will be more fully understood from the following detailed description taken with the drawing, wherein:

FIG. 1 shows an end view of an optical reflex reproducing device of the invention;

FIG. 2 shows a side exploded view of the device of FIG. 1;

FIG. 3 shows a sectional view of the device of FIG. 1 along the lines 3—3 with the circuit shown schematically;

FIG. 4 shows the relation of the exposing head of the device of FIG. 1 with the printed copy;

FIG. 5 shows an end view of a modification of the device of FIG. 1;

FIG. 6 shows a side view partially cut away of the device of FIG. 5;

FIG. 7 shows a partial sectional view of the device of FIG. 6 along the lines 7—7;

FIG. 8 shows the shutter used in the device of FIG. 5, and

FIG. 9 shows another use for the device of FIGS. 1 and 5.

It often becomes desirable or necessary to obtain partial or whole copies of information such as pages of books or other bound documents in which the removal of the pages is difficult or undesirable.

With prior art devices, the bulk of the apparatus necessary to obtain the material, even in the most compact forms, is excessive and the skill and time required for obtaining the proper conditions severely restricts the use of such apparatus.

The device of this invention makes it possible to copy written, printed or graphic matter, all of which will be called printed material in this disclosure, by the simple act of passing a self-contained hand-sized unit over the material of interest. The device of the invention is loaded with photosensitive paper or thin base film, which will be referred to as photosensitive material in this disclosure. The device is used to make the copy without regard to ambient or prevailing light and automatically stores and protects the latent images collected until the device is unloaded for development by normal processing methods.

Referring more particularly to FIGS. 1, 2 and 3 of the drawing, reference number **10** refers to a reflex copy-reproducing device having a housing **11**. Housing **11** has two parts, **12** and **13**, shown in FIG. 2. The bottom portion **13** has supported thereon a supply spool **14** and a take-up spool **15**. The supply spool **14** is supported upon the bottom portion **13** by means of support arms **16**, one of which is shown in FIG. 2. The take-up spool **15** is mounted upon movable arms **17** which are pivoted at **18**. The upper housing **12** has therein a light source

22, which provides illumination at the exposing head **23**. The light source is supplied from power supply **24** and is energized by the closing of switch **25** which is controlled by the "on" button **26** shown in FIG. 2. The light source is inserted into a hole in a block **29** of light transmitting material having light diffusing properties which in the device built was a block of "Lucite" which is integral with the exposing head **23**. An opaque coating **27** shields the film from the light source **22**. Although the light source is schematically shown as an ordinary non-linear filament lamp, it is preferable that a line light source be used. Photosensitive material **20**, from supply spool **14**, passes over the exposing head **23** over an idler roller **30** and onto the take-up spool **15**. A metering roller **31** contacts the photosensitive material **20** on the take-up spool **15** and drives the take-up spool at substantially the same speed as the copy-reproducing device is moved across the copy sheet. A one-way clutch mechanism **32** keeps the take-up spool from being driven in the wrong direction. Though this is shown as a cam and ball type one-way clutch, it is obvious that other types could be used, if desired. A spring **19** is provided to urge the take-up spool **15** against the metering roller **31**. A shim stock light seal **33** is provided between the photosensitive material and the bottom portion **13** of housing **11**. Felt light seals **34** and **35** are provided on both sides of the metering roller **31**. The light seal **34** extends over into contact with the photosensitive material **20**. A meter **36** is provided to indicate the amount of photosensitive material remaining on the supply spool **14**. An arm **37** in contact with the paper on spool **14** actuates the meter to provide the indication. A pair of "Teflon" strips **38** and **39** are provided as sliding surfaces. Strip **39** has a raised portion **40** thereon.

In the operation of the device with switch **25** closed and the light source **22** energized, the copying device is held in the hand of the operator and passed over printed copy **41** as shown in FIG. 4.

Since the take-up spool **15** is driven by the metering roller **31** with the metering roller in contact with the photosensitive material **20**, the photosensitive material will pass the exposing head **23** at substantially the same speed as the reflex copying device is passed over the paper. There will, therefore, be substantially no relative movement between the photosensitive material **20** and the copy **41**. The photoemulsion **42** on photosensitive material **20** is exposed by normal reflex action as indicated by the arrows **43** and **44**. Since the photosensitive material will remain stationary over the exposing head while the device is being returned for another sweep of the copy, a black bar will be produced to automatically indicate the beginning and end of each pass of the device across the page.

As can be seen, the exposing time is determined by the time that the photosensitive material is positioned over the exposing head **23** and is therefore determined by the speed of the movement of the device over printed copy. Usually, the exact speed at which the device is moved is not critical and with a little practice an operator will be able to move the device at a speed which falls within the acceptable range. However, if the exposing time is critical, the device may be modified as shown in FIG. 5, which shows two auxiliary housings **45** and **46** attached to the side of housing **11**. With this modification, two overlapping cylindrical holes would be drilled through the light diffuser **29**. An elongated light source **47** would be mounted in the upper hole **48** and a light shutter **49** would be mounted in the lower hole **48A**. The light source **47** would be surrounded by a light reflecting opaque coating **50** located on the inner wall of hole **48**. The shutter **49** would be driven by linkages **51** connected to

magnets 52 which are driven by drag cups 53, connected to driving rollers 54. As can be seen from FIG. 7, the shutter 49 would be driven from both sides of the device. Tensioning springs 55, one of which is shown, provide a restoring torque for the drag cup shutter operating devices. The tension of the springs 55 may be adjusted by means of adjustments 56, one of which is shown.

In the operation of the device, when the reflex copy-reproducing device is at rest, the shutter is in the position shown with the shutter element 60 covering the opening in the bottom of hole 48 so that no light can pass into the diffuser 29. As the device is moved, the amount of torque applied to magnets 52 by drag cups 53 is determined by the speed at which the device is moved across the paper and, thus, the amount that the shutter is opened is determined by this speed. In this way, the illumination is kept substantially constant regardless of speed.

While the device of the invention has been described as being useful for making copies of printed material, it is obvious that the device could also be used for making reproductions by reloading the developed film or photosensitive paper in the device and passing it across a photosensitive sheet as shown in FIG. 9, which shows a developed film 65 in contact with photosensitive material 66 mounted on a backing sheet 67. This reproduction would have to take place in either a darkroom or under subdued light, as determined by the sensitivity of photosensitive material 66 used and the strength of the light. This reproduction would be produced by normal exposure and not by reflex action.

Though the light source has been described as being located in the block of light transmitting material with diffusing properties, it is obvious that numerous other means for providing substantially uniform light at the exposing head will occur to thoses killed in the art and could be used if desired.

There is thus provided a copy-reproducing device which is capable of reproducing copies without having to remove the pages from bound documents.

While certain specific embodiments have been described in some detail, it is obvious that numerous changes can be made without departing from the general scope of the invention.

I claim:

1. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an elongated opening in said housing; an elongated exposing head projecting into said opening; means, contacting both said printed and photosensitive materials and responsive to the speed of movement of the copying device over said printed material, for moving said photosensitive material past said exposing head in contact with said exposing head at substantially the same speed as the speed of motion of copying device; means for supplying substantially uniform illumination for said exposing head; means for shielding said photosensitive material from said illumination, except at the area of contact of the photosensitive material and the exposing head.

2. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an exposing head; means, responsive to the speed of movement of the copying device over said printed material, for moving said photosensitive material past said exposing head at substantially the same speed as the speed of motion of copying device; means for supplying substantially uniform illumination for said exposing head; means for shielding said photosensitive material from said illumination, except at the area of contact of the photosensitive material and the exposing head; and means, responsive to the speed of movement of the copying device over the printed material, for maintaining the effective exposure of the photosensitive material substantially constant.

3. A reflex copying device comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an elongated opening in said housing; an elongated exposing head projecting into said opening; means, contacting both said printed and photosensitive materials and responsive to the speed of movement of the reflex copying device for moving said photosensitive material past said exposing head in contact with said exposing head at substantially the same speed as the speed of motion of copying device; a light diffusing medium adjacent said exposing head; a light source located within said light diffusing medium; means for energizing said light source; and means for shielding said photosensitive material from the light from said light source except at the area of contact of the photosensitive material and the exposing head.

4. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an elongated opening in the bottom of said housing; an elongated stationary exposing head extending across the bottom of said housing and projecting into said opening; means, contacting both said printed and photosensitive materials and responsive to the speed of movement of the copying device over said printed material, for moving said photosensitive material past said exposing head in contact with said exposing head and said printed material and at substantially the same speed as the speed of motion of copying device; a light diffusing medium adjacent said exposing head; a line light source located parallel to said diffusing head within said light diffusing medium; means for energizing said light source; and means for shielding said photosensitive material from the light from said light source except at the area of contact of the photosensitive material and the exposing head.

5. A reflex copying device comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an exposing head; means, responsive to the speed of movement of the reflex copying device, for moving said light sensitive paper past said exposing head at substantially the same speed as the speed of motion of copying device over the printed material; a light diffusing medium adjacent said exposing head; a light source located within said light diffusing medium; means for energizing said light source; means for shielding said photosensitive material from the light from said light source, except at the area of contact of the photosensitive material and the exposing head; and means, responsive to the speed of movement of the copying device over the printed material, for controlling the amount of light at said exposing head.

6. A reflex copying device comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an exposing head; means, responsive to the speed of movement of the reflex copying device for moving said light sensitive paper past said exposing head at substantially the same speed as the speed of motion of copying device; a light diffusing medium adjacent said exposing head; a light source located within said light diffusing medium; means for energizing said light source; means for shielding said photosensitive material from the light from said light source except at the area of contact of the photosensitive material and the exposing head; a shutter between said light source and said exposing head; and means responsive to the speed of movement of the reflex copying device for opening said shutter as the speed of said copying device is increased.

7. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an elongated opening in said housing; an elongated exposing head projecting into said opening; a metering roller, adapted to roll over the printed material in contact therewith; means for urging the photosensitive material on said take-up spool into contact with said metering roller, whereby said photosensitive material is moved past said exposing head in contact with said exposing head and said printed material and at substantially the same speed as the speed of motion of the copying device over the printed material; a light diffusing medium adjacent said exposing head; a light source located within said light diffusing medium; means for energizing said light source; and means for shielding said photosensitive material from the light from said light source except at the area of contact of the photosensitive material and the exposing head.

8. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an elongated opening in said housing; an elongated exposing head projecting into said opening; a metering roller adapted to roll over the printed material; means for urging the photosensitive material on said take-up spool into contact with said metering roller, whereby said photosensitive material is moved past said exposing head at substantially the same speed as the speed of motion of the copying device over the printed material; a light diffusing medium adjacent said exposing head; a light source located within said light diffusing medium; means for energizing said light source; means for shielding said photosensitive material from the light from said light source except at the area of contact of the photosensitive material and the exposing head; and means, responsive to the speed of movement of the copying device, for controlling the amount of light at said exposing head.

9. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; an exposing head; a metering roller adapted to roll over the printed copy; means for urging the photosensitive material on said take-up spool into contact with said metering roller, whereby said photosensitive material is moved past said exposing head at substantially the same speed as the speed of motion of the copying device over the printed material; a light diffusing medium adjacent said exposing head; a light source located within said light diffusing medium; means for energizing said light source; means for shielding said photosensitive material from the light from said light source except at the area of contact of the photosensitive material and the exposing head; a shutter between said light source and said exposing head; and means, responsive to the speed of movement of the copying device over the printed material, for opening said shutter as the speed of the copying device is increased.

10. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; a block of light transmitting material, with light diffusing properties, within said housing; said block being tapered toward a narrow head, to thereby provide an exposing head; means, responsive to the speed of movement of the copying device over the printed material, for moving the photosensitive material past said exposing head at substantially the same speed as the speed of motion of the copying device; a first cylindrical shaped hole through said block parallel to said exposing head; a light source within said first hole; means for energizing said light source; a second overlapping cylindrical shaped hole in said block parallel to said first hole and located between said first hole and said exposing head; a shutter forming a cylindrical section located within said second hole, said shutter having two cylindrical shaped end portions; means, responsive to the speed of movement of the copying device over the printed material, for opening said shutter as the speed of the copying device is increased; a light reflecting opaque material on the inner wall of said first hole; and means, on the surface of said block, for shielding said photosensitive material from the light from said light source, except at the area of contact of said photosensitive material and the exposing head.

11. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; a block of light transmitting material, with light diffusing properties, within said housing; said block being tapered toward a narrow head, to thereby provide an elongated exposing head; a metering roller adapted to roll over the printed copy; means for urging the photosensitive material on said take-up spool into contact with said metering roller, whereby said photosensitive material is moved past said exposing head at substantially the same speed as the speed of motion of the copying device over the printed material; a first cylindrical shaped hole through said block parallel to said exposing head; a light source within said first hole; means for energizing said light source; a second overlapping cylindrical shaped hole in said block parallel to said first hole and located between said first hole and said exposing head; a shutter, forming a cylindrical section, located within said second hole; said shutter having two cylindrical shaped end portions; means, responsive to the speed of movement of the copying device over the printed material, for opening said shutter as the speed of the copying device is increased; a light reflecting opaque material on the inner wall of said first hole; and means, on the surface of said block, for shielding said photosensitive material from the light from said light source, except at the area of contact of said photosensitive material and the exposing head.

12. A device for producing a copy of printed material comprising: a light-tight housing; a photosensitive material supply spool and take-up spool within said housing; means for supporting said spools within said housing; a block of light transmitting material, having light diffusing properties, within said housing; said block being tapered toward a narrow head, to thereby provide an elongated exposing head; a first cylindrical shaped hole through said block parallel to said exposing head; a metering roller adapted to roll over the printed copy; means for urging the photosensitive material on said take-up spool into contact with said metering roller, whereby said photosensitive material is moved past said exposing head at substantially the same speed as the speed of motion of the copying device over the printed material; means within said metering roller for preventing rotation of said roller in a direction tending to unwind the photosensitive material on said take-up spool; an elongated light source within said first hole; means for energizing said light source; a second overlapping cylindrical shaped hole in said block parallel to said first hole and located between said first hole and said exposing head; a shutter in the form of a cylindrical section located within said second hole; said shutter having two cylindrical shaped end portions; at least one magnetic speed responsive device located adjacent said light-tight housing; a mechanical linkage for connecting the output of said magnetic speed responsive device to said shutter; means, responsive to the speed of movement of the copying device over the printed material, for energizing said speed responsive device to supply a torque for opening said shutter as the speed of the copying device is increased; an adjustable means for opposing

said torque; a light reflecting opaque material on the inner wall of said first hole; means, on the surface of said block, for shielding said photosensitive material from the light from said light source, except at the area of contact of said photosensitive material and the exposing head; and means, mounted on said housing and mechanically coupled to the photosensitive material on said supply spool, for indicating the amount of photosensitive material remaining on said supply spool.

13. In a continuous exposure type of reflex copying device, a variable light source responsive to speed of said device comprising: a block of light transmitting material with light diffusing properties; said block being tapered toward a light transmitting head; a first cylindrical shaped hole through said block; a light source within said first hole; means for energizing said light source; a second overlapping cylindrical shaped hole in said block parallel to said first hole and located between said first hole and said light transmitting head; a shutter in the form of a cylindrical section located within said second hole; means, responsive to speed, for rotating said shutter in said second hole, to thereby open said shutter in response to an increase in speed; a light reflecting opaque material on the inner wall of said first hole.

14. In a movable continuous exposure type of reflex copying device, a variable light source responsive to speed of said device, comprising: a block of light transmitting material, said block being tapered toward a narrow, elongated head; a first cylindrical shaped hole through said block parallel to said elongated head; an elongated light source within said first hole; means for energizing said light source; a second overlapping cylindrical shaped hole in said block parallel to said first hole and located between said first hole and said elongated head; a shutter in the form of a cylindrical section located within said second hole; said shutter having two cylindrical shaped end portions; a rotatable drag cup; magnetic means responsive to the speed of rotation of said drag cup, for rotating said shutter in said second hole; an adjustable means for opposing said rotation; a light reflecting opaque material on the inner wall of said first hole; an opaque coating on all of the surfaces of said block, except said elongated head portion.

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