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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

(NASA-Case-LAR-10226-1) APPARATUS FOR PHOTOGRAPHING METEORS Patent (NASA)
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Unclas 64780
00/14

REPLY TO ATTN OF: GP

TO: KSI/Scientific & Technical Information Division
Attention: Miss Winnie M. Morgan

FROM: GP/Office of Assistant General Counsel for Patent Matters

SUBJECT: Announcement of NASA-Owned U.S. Patents in STAR

In accordance with the procedures agreed upon by Code GP and Code KSI, the attached NASA-owned U.S. Patent is being forwarded for abstracting and announcement in NASA STAR.

The following information is provided:

U.S. Patent No. : 3,712,195
Government or Corporate Employee : U.S. Government
Supplementary Corporate Source (if applicable) : _____
NASA Patent Case No. : LAR-10,226-1

NOTE - If this patent covers an invention made by a corporate employee of a NASA Contractor, the following is applicable:

Yes No

Pursuant to Section 305(a) of the National Aeronautics and Space Act, the name of the Administrator of NASA appears on the first page of the patent; however, the name of the actual inventor (author) appears at the heading of column No. 1 of the Specification, following the words " . . . with respect to an invention of . . . "

Elizabeth A. Carter

Elizabeth A. Carter
Enclosure
Copy of Patent cited above



[54] **APPARATUS FOR PHOTOGRAPHING METEORS**

[75] Inventor: **Gale A. Harvey**, Hampton, Va.

[73] Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**

[22] Filed: **Dec. 16, 1970**

[21] Appl. No.: **98,774**

[52] U.S. Cl. **95/11 R, 95/11.5 R, 250/217 R**

[51] Int. Cl. **G03b 19/02**

[58] Field of Search **95/11, 11.5, 4.5, 12.5, 53 E; 250/217 R**

[56] **References Cited**

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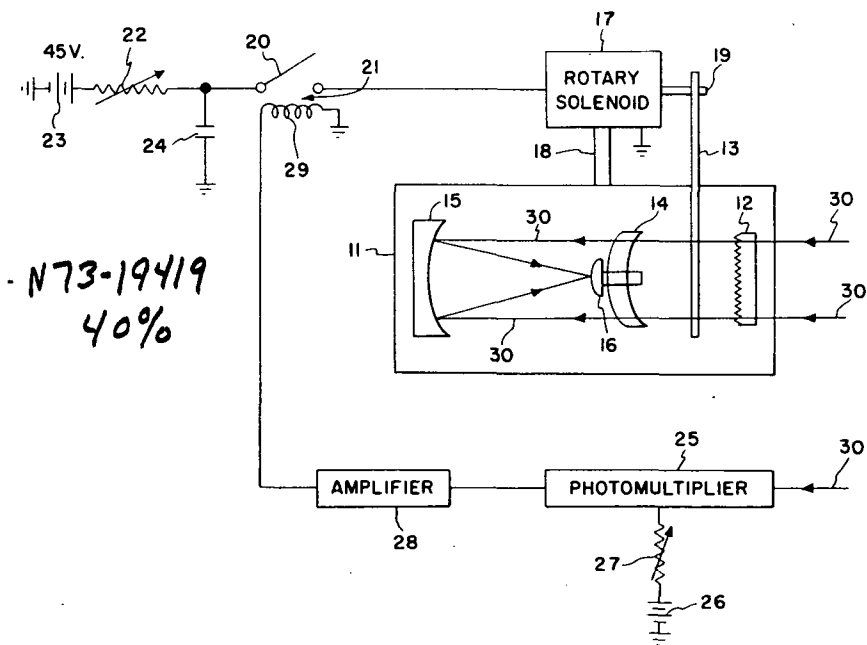
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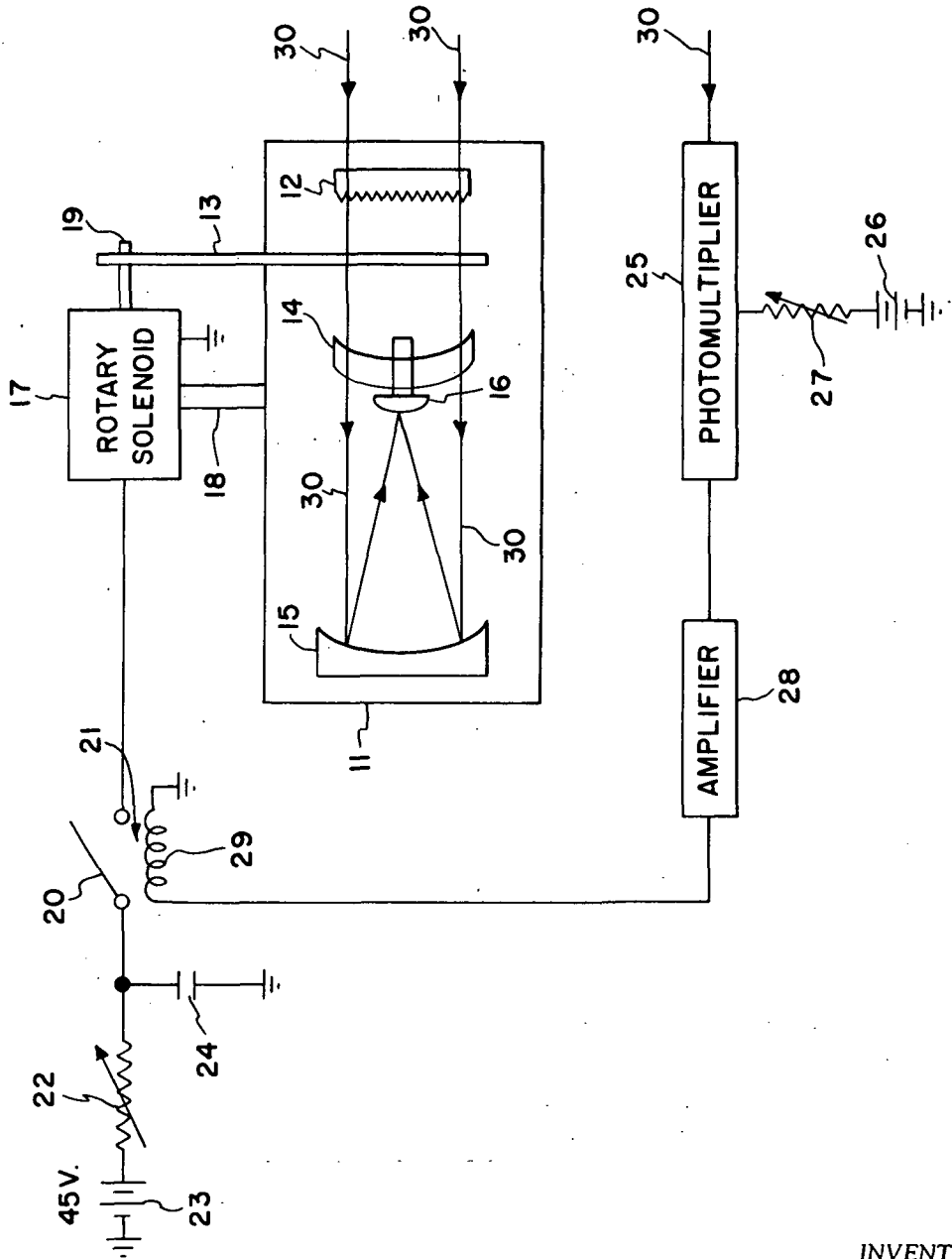
Primary Examiner—Samuel S. Matthews
Assistant Examiner—Kenneth C. Hutchison
Attorney—Howard J. Osborn, William H. King and John R. Manning

[57] **ABSTRACT**

Apparatus for photographing meteors in a selected area of the sky only at times meteors are likely to be passing through the area. A photomultiplier is pointed in the direction of the area. When a meteor passes through the area the signal output of the photomultiplier increases. Means are provided that activates a camera, pointed at said area, in response to an increased signal from the photomultiplier. Hence, the camera photographs the selected area only while meteors are likely to be passing through the area.

2 Claims, 1 Drawing Figure





INVENTOR.
GALE A. HARVEY
BY *Howard J. Robinson*
William H. King
ATTORNEYS

APPARATUS FOR PHOTOGRAPHING METEORS**ORIGIN OF THE DISCLOSURE**

The invention described herein was made by an employee of the United States Government and may be manufactured and used by or for the Government for governmental purposes without the payment of royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The invention relates generally to photography and more specifically concerns photographing meteors in a selected area of the sky.

The prior art of photographing meteors points a camera in the direction of the selected area in the sky to be photographed and then continuously exposes the film in the camera. The disadvantages of the prior art are that when a framing camera is used the film has to be continuously cycled (in a framing mode) through the camera and when the film is on plates the plates have to be changed every 30 seconds to 5 minutes because of night sky radiation and starlight. Also the prior art devices cannot be operated on nights when the moon is up and they have a low ratio of meteors photographed to film exposed. It is therefore the primary purpose of this invention to provide apparatus for photographing meteors in which the film is exposed only while meteors are likely to pass through the area in the sky being photographed.

SUMMARY OF THE INVENTION

The invention consists essentially of a camera and a photomultiplier pointed in the direction of the area in the sky to be photographed. When a meteor is in this area the resulting increase in light intensity causes the photomultiplier to produce an increased electrical signal. Means are provided which are responsive to this increased signal for opening the shutter of the camera. When the electrical signal decreases back to its normal value, the shutter closes. Hence, the film in the camera is exposed only while a meteor is in the selected area of the sky. The means for opening the shutter includes a relay which has the electrical signal from the photomultiplier applied to its coil. When the electrical signal increases to a predetermined value the contacts of the relay close and apply a voltage to a rotary solenoid. This solenoid has its shaft coupled to the shutter of the camera to open the shutter while voltage is applied to the solenoid. Capacitor means are provided to apply a large current to the solenoid at the instant the contacts of the relay close to overcome the inertia of the shutter thereby making the shutter open faster.

BRIEF DESCRIPTION OF THE DRAWING

The sole FIGURE in the drawing is a schematic diagram of the embodiment of the invention selected for illustration.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the embodiment of the invention selected for illustration in the drawing, the number 11 designates a camera. Camera 11 includes a diffraction grating 12, a shutter 13, a corrector lens 14, a primary mirror 15 and a focal surface 16. A rotary solenoid 17 is attached to camera 11 by any suitable means 18. The

shaft 19 of rotary solenoid 17 is coupled to shutter 13 such that when a voltage is applied to rotary solenoid 17, shaft 19 rotates and rotates shutter 13 out of the path of the light that passes through diffraction grating 12. The input of rotary solenoid 17 is connected to one of the contacts 20 of a relay 21. The other contact 20 is connected through a variable resistor 22 to a 45 volt power source 23. Capacitor 24 which is capable of charging to 45 volts is connected between ground and the junction of resistor 22 and contacts 20. Capacitor 24 can be a bank of capacitors instead of a single capacitor as shown. The purpose of capacitor 24 is to apply a large current to rotary solenoid 17 the instant contacts 20 close to overcome the inertia of shutter 13 and make it fast-acting. The purpose of variable resistor 22 is to keep the voltage across rotary solenoid 17 constant at about 6 volts after capacitor 24 is discharged. A photomultiplier 25 has its power supply 26 connected to it through a variable resistor 27. The output of photomultiplier 25 is connected through an amplifier 28 to the coil 29 of relay 21. The purpose of variable resistor 27 is to vary the sensitivity of photomultiplier 25 so that the contacts 20 of relay 21 will close at some predetermined intensity of light coming into the photomultiplier.

In the operation of this invention film is placed on the focal surface 16 of camera 11 and the camera is pointed so that it covers the selected area in the sky to be photographed. We will assume initially that there are no meteors in the area, then the light rays 30 from the selected area are blocked by shutter 13. Variable resistor 27 is adjusted so that a meteor with a predetermined light intensity will cause photomultiplier 25 to produce a signal large enough to actuate relay 21. Photomultiplier 24 is then pointed so that it covers the selected area in the sky. Inasmuch as there is no meteor in the area selected to be photographed, the contacts 20 are open as shown, the shutter 13 is closed and blocks light rays 30 and the capacitor 24 is charged to 45 volts. At the instant a meteor moves into the selected area the light rays 30 from this area causes photomultiplier 25 to produce a signal with a magnitude sufficient to actuate relay 21 to close contacts 20. This applies the 45 volt charge on capacitor 24 to rotary solenoid 17 causing shutter 13 to open immediately. The light rays 30 then pass through the corrector lens 14 and are reflected back onto the film on focal surface 16 forming an image of the meteor on the film. When the meteor moves out of the selected area, photomultiplier 25 does not produce a signal large enough to hold the contacts 20 of relay 21 closed. Hence, contacts 20 open, shaft 19 of rotary solenoid 17 rotates back to its original position closing shutter 13, and a capacitor 24 again charges to 45 volts. Consequently the film in the camera is exposed only when a meteor is in the area of the sky being photographed.

The advantage of this invention is that it provides a simple, inexpensive means for photographing meteors in which the film is exposed only when there is a meteor in the area in the sky being photographed.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment. Various changes may be made without departing from the spirit or scope of the invention as defined in the subjoined claims. For example, an

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internal iris-type shutter could be used instead of a blade-rotary solenoid shutter. Different fields of view (20°, 30°, 40°); different apertures (3½ inches, 5 inches, 6 inches, 8 inches); and different color filters on the photomultiplier tube could be used.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Apparatus for photographing meteors in a selected area of the sky comprising: means for producing an electrical signal proportional to the intensity of light emanating from said selected area of the sky; means for photographing said selected area of the sky while activated including a shutter, a rotary solenoid attached to the shutter for rotating the shutter whenever power is applied to the rotary solenoid, a power source, a relay having its coil connected to said means for producing an electrical signal and having its contacts connected between said power supply and said rotary solenoid, and capacitor means connected between the

junction of said contacts and said power supply so that it is charged while said contacts are open whereby whenever the intensity of said light exceeds said predetermined value said contacts close applying a large surge of current to said rotary solenoid to cause it to rapidly operate said shutter; and means responsive to said electrical signal for activating said photographing means while the amplitude of said electrical signal exceeds a predetermined value whereby said photographing means photographs said selected area of the sky only at times meteors are likely to be passing through said selected area.

2. Apparatus according to claim 1 including a variable resistor connected between said power supply and said capacitor means for regulating the voltage applied across said rotary solenoid while said contacts are closed.

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