NASA TECHNICAL MEMORANDUM NASA TM-75481

'HELIOSTAT" FOR ASTRONOMICAL USAGE

Gustav Heyde

Translation of: "Heliostat für astronomische Zwecke", Patentiert im Deutschen Riche vom 16 Dezember 1919, 2 pages.

(NASA-TM-75481) HELIOSTAT FOR ASTRONOMICAL USAGE (National Aeronautics and Space Administration) 7 p HC A02/MF A01 CSCL 03A

N79-24920

Unclas
G3/89 20920

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546 MAY 1979

STANDARD TITLE PAGE

1. Report No. NASA TM-7,481	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle 'HELIOSTAT' FOR ASTRONOMICAL USAGE		5. Report Date May 1979
		6. Performing Organization Code
7. Author(s) Gustav Heyde		8. Performing Organization Report No.
		10. Work Unit No.
9. Performing Organization Name and Address SCITRAN 1482 East Valley Road Santa Barbara, CA 92108		11. Contract or Grant No. NASW-3198
		13. Type of Report and Period Covered Translation
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D. C. 20546		14. Sponsoring Agency Code

15. Supplementary Notes

Translation of: "Heliostat fur astronomische Zwecke," Patentiert im Deutschen Riche Vol.16, December 1919, 2 pages

16. Abstract

17. Key Words (Selected by Author(s))	18. Distribution Statement Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22.
Unclassified	Unclassified	7	

GERMAN REICH

REICHS PATENT OFFICE. PATENT DOCUMENT NO. 326516.
class 42 H, Group 8.
Issued on September 29, 1920.

Gustav Heyde G. m. b. H. in Dresden.
Heliostat for astronomical applications.
Patented in the German Reich after December 16, 1919.

Heliostats are often used for astronomical applications. In many cases it is necessary to fix telescopes and mirror telescopes. In this case they do not track the daily motion of the stars because, at least for certain purposes, there are incompatabilities associated with the latter configuration.

One particular advantage of a fixed telescope is that it is easier to protect against disturbances by the wind and other perturbations, compared with one with a parallactic mounting or which is driven by a clockwork.

Many methods have been given of moving mirrors using clockworks or other drive mechanisms in such a manner that the light of the stars reflected by them is reflected in a fixed direction which does not change.

However, for astronomical purposes, only two typically different designs have become known up to the present time. First of all there is the Foucault design and also the Lippmann design (Journal of physics (France), year 1895). In the Foucault heliostat design, one axis is in direction of the world axis and in 24 hours it is rotated once by a clockwork; depending on the purpose of the instruments sometimes it is moved either in 24 hours of star time or in 24 hours of mean solar time. The mirror S is mounted so that it can be rotated around an axis perpendicular to the world axis. When the instrument is used it has a position such that the reflected rays run in the direction of the world axis.

It is easily seen that if the clockwork U is correctly controlled and if the mirror S has the correct position, the axis of the ray bundle can be maintained constant. However, it can also be realized that the light bundle itself rotates around this axis.

Therefore, if we make observations through a telescope with a direction fixed in the direction of the world axis and observe a star, there will be no motion in the center of the field of view. However, the imagine will continuously turn slowly around its center.

In applications of observational astronomy and for all astronomical-photographic tasks where only short exposure times are required, this rotation is of no consequence. On the other hand, no continuous photographic exposures can be made using such a configuration, because the imagine would be unsharp. This advantage is contrasted by the advantage that only a single mirror is used and the telescope can always remain fixed. For the correct configuration it is possible to observe stars at any point of the sky without having especially unfavorable incidence angles of the rays at the mirror.

The Lippmann heliostat is based on another principle. In this case the mirror is attached to a rotating axis which is parallel to the world axis, but it cannot be rotated in the perpendicular direction. Instead it lies once and for all in the plane of the world axis. Now if the axis of the instrument is driven by a clockwork or other drive mechanism for 48 star time hours or 48 mean solar time hours, it can be shown that for a telescope which has a horizontal position, the rays of an object moving through the sky is not changed by the earth's rotation. Instead the rays are always projected in the same direction, if the horizontal telescope has a such an azimuth direction so that its axis is oriented along the ascending or descending point of the star as seen from the heliostat. The image does not rotate in the telescope, but remains unchanged in the field of view at rest. Therefore, one can use such a Lippmann heliostat for continuous exposures, for example, for the fixed star sky or the moon.

In addition to this advantage, the Lippmann design also has some disadvantages. As a simple analysis shows,and which will not be repeated here (see the indicated references), not all of the stars are accessible for this heliostat. The entire circumpolar part of the sky cannot be observed, and the angles of the mirror which are used are sometimes very unfavorable under some conditions.

The present invention considers the design of the heliostat, which incorporates the advantages of the Foucault design and the Lippman design. The drawing shows this heliostat.

The heliostat consists of a mechanical polar axis x-x' which can be rotated and which is parallel to the world axis. Mirror S is supported in such a manner that it can be rotated arbitrarily around a declination axis y-y' which is perpendicular to it. Or after execution of this rotation it can be clamped in the plane of the world axis which can be corrected and verified by special collimation directions. The clockwork or drive unit U can be driven for a 24 hour or 48 hour complete rotation of the axis using any known device such as switchable gears, without changing its regular variation related to stellar time or mean solar time. Telescopes can then be attached to the heliostat which have a direction fixed in the direction of the world axis. Other telescopes can be attached which are mounted horizontally and can be deflected in the azimuth direction. In order to set the rise and set point of a star to be observed, a divided circle can be used either from a calculation or using a table. This table is calculated for any geographic latitude. Using the declination of the star at the time one then finds the azimugh from the table. If the mirror is corrected (?), then when rotating the world axis (*), the star must appear in the field of view of the telescope. After switching on the clockwork U it must remain unchanged in this position. It is obvious that the horizontal ray which emerges at a certain azimugh can be displaced into another appropriate fixed direction, for example perpendicular downwards, by means of another auxiliary mirror.

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PATENT CLAIMS

1. Heliostat with selectable rotation rate of the axis parallel to the world axis, characterized by the fact that there are provisions to use it like a Foucault heliostat if its axis performs one rotation in 24 hours and uses a telescope oriented along the world axis. If the world axis rotates once completely in 48 hours it can be used like a Lippmann heliostat using a telescope which can be displaced horizontally, after the plane of the mirror has been brought into the world axis.

2. Heliostat according to claim 1 characterized by the fact that the heliostat clockwork is connected with a gear drive in such a manner that the rotation of the instrument mean axis occurs in 24 hour or 48 hour intervals, and the mirror which can be rotated perpendicular to the world axis can be clamped in the plane of the world axis.

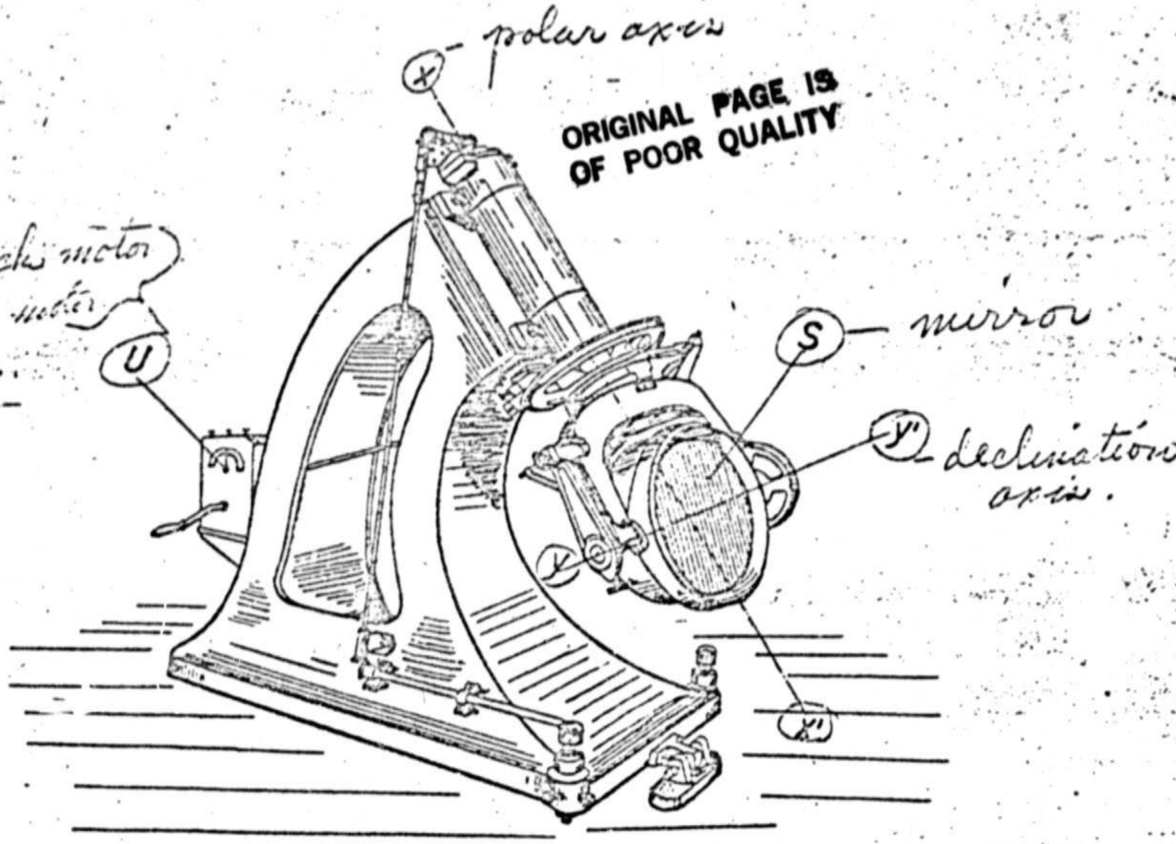
1 figure attached.

* Translator's note: Misprint in this sentence.

353/23 326,516 - German Sept. 29, 1920.

Zu der Patentschrift 326516

(gr281) G. Heyde - 9-1920



may be clock motor or electric motor l. 43, 44, p. 2.

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