

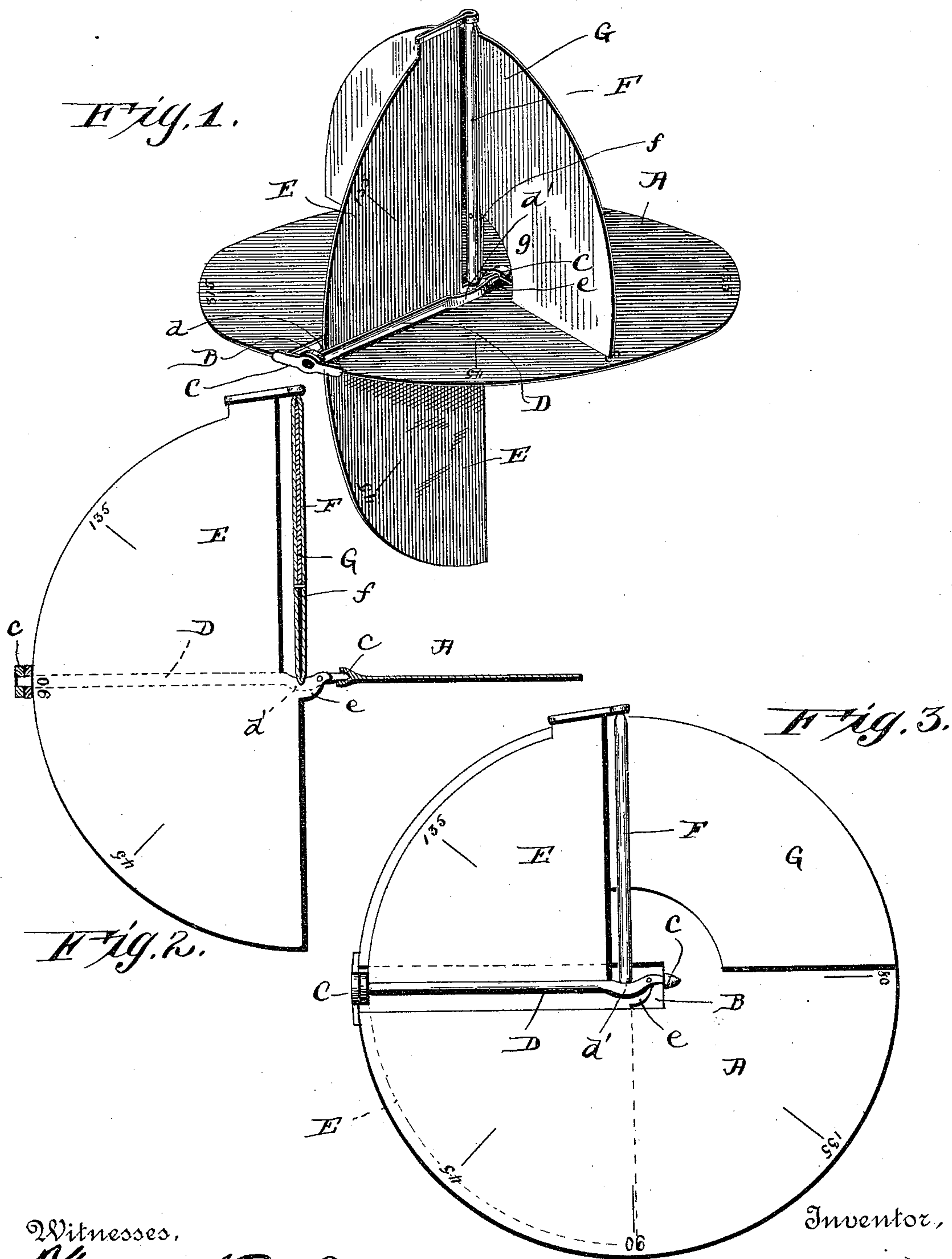
(No Model.)

F. HAWK.

APPLIANCE FOR ILLUSTRATING SPHERICAL TRIGONOMETRY.

No. 405,354.

Patented June 18, 1889.



Witnesses,

Frank A. Oberlin  
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By his Attorneys

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# UNITED STATES PATENT OFFICE.

FLETCHER HAWK, OF LEBANON, OHIO.

## APPLIANCE FOR ILLUSTRATING SPHERICAL TRIGONOMETRY.

SPECIFICATION forming part of Letters Patent No. 405,354, dated June 18, 1889.

Application filed November 16, 1888. Serial No. 291,048. (No model.)

*To all whom it may concern:*

Be it known that I, FLETCHER HAWK, a citizen of the United States, residing at Lebanon, in the county of Warren and State of Ohio, have invented a new and useful Improvement in Trigonometrical Appliances, of which the following is a specification.

My invention relates to a trigonometrical appliance; and it consists in a certain novel construction and combination of devices, fully described hereinafter in connection with the accompanying drawings and specifically pointed out in the appended claims.

In the demonstration of principles and problems in spherical trigonometry and solid geometry it is desirable to have some tangible object by which the various forms and the relations between lines and planes may be accurately illustrated, in order that pupils of feeble or sluggish imaginations may be enabled to comprehend readily the basal facts in these branches of mathematics. It is therefore my object to provide a device whereby plane and solid angles and triangles may be formed, so that the teacher before a class (or the pupil who is deprived of class-room privileges) may readily and quickly elucidate satisfactorily the foundation principles in the branches of instruction referred to, and thus save much time which would otherwise necessarily be occupied in explanation and study.

In order that my invention may be more fully understood and the advantages thereof better appreciated, I have illustrated the same in the accompanying drawings, wherein—

Figure 1 is a perspective view. Fig. 2 is a vertical sectional view taken longitudinally of the slot in the disk. Fig. 3 is a similar view with the half-disks in a different position.

Referring to the drawings by letter, A designates a disk, which is provided with a radial slot B, extending from the periphery to a point slightly beyond the center of the disk, and at the inner and outer ends of this slot are formed bearings C C, in which are mounted the ends of the shaft D. This shaft is provided with a longitudinal slot  $d$ , having an enlargement  $d'$  at its inner end, and in this slot is arranged the half-disk E, which is

provided at the center of its straight or inner side with the trunnion  $e$ , pivoted in the said enlargement  $d'$ . It will be seen that the half-disk E is capable of a rotary movement around the slotted shaft, whereby it may be caused to assume a position at any desired angle to the plane of the disk A; and, further, the half-disk may also be moved around its pivot in the enlargement  $d'$ , whereby it may be caused to assume a position on either side of the disk A or may be allowed to extend through the slot B, as shown in Fig. 1 of the drawings.

In suitable aligned bearings, which are arranged, respectively, in the trunnion  $e$  and on one extremity of the half-disk E, are mounted the ends of the shaft F, provided with a longitudinal slot  $f$ , which terminates a short distance from the inner end of the shaft. In this slot is mounted the half-disk G, and from its center is cut a semicircle  $g$ , concentric with the periphery of the disk, whereby all points on the semicircle are equidistant from the periphery of the disk when measured on the radii of the latter, thus enabling the disk to be arranged in any desired position in the slot or removed therefrom entirely.

Upon the disk and half-disks may be printed, impressed, or otherwise indicated any desired system of notation, whereby any desired angles may be formed between the disks.

By the proper manipulation of the parts of this device any principle or problem in spherical trigonometry and many propositions in spherical geometry may be clearly and fully demonstrated and illustrated, whereby the most obtuse pupil will be enabled to understand, and when the device is not in use it may be folded flat to occupy a small space, whereby it may be carried in the pocket.

Having described my invention, I claim—

1. In an educational appliance, the combination of the disk A, provided with a slot, and the half-disk mounted in the slot and adapted to assume a position at any desired angle to the disk A, whereby plane and spherical angles may be illustrated, substantially as specified.

2. As an educational appliance, the combination of the disk A, provided with a slot B,



the half-disk E, mounted in the said slot, and the half-disk G, swiveled to the edge of the half-disk E, substantially as specified.

3. In an educational appliance, the combination of the disk A, provided with a radial slot B, the slotted shaft mounted at its ends in bearings at the ends of said slots, the half-disk E, arranged in the slot in said shaft, and the half-disk G, swiveled to the edge of the half-disk E, substantially as specified.

4. In an educational appliance, the combination of the disk A, provided with the radial slot B, the slotted shaft D, mounted in bearings in the said slot, the disk E, arranged in the slot and pivoted at its inner edge to the shaft, and the half-disk G, swiveled at its center to the edge of the disk E, substantially as specified.

5. In an educational appliance, the combination of the disk A, provided with the slot B, the slotted shaft D, mounted in the slot, the half-disk E, arranged in the slot in the

shaft, the slotted shaft F, mounted in bearings on the half-disk, and the half-disk G; arranged in the slot in the shaft F, substantially as specified.

6. In an educational appliance, the combination of the disk A, provided with a slot B, the slotted shaft D, mounted in the slot B, the half-disk E, pivoted in the slot in the said shaft, the shaft F, mounted in bearings on the edge of the half-disk E and provided with a slot *f*, terminating a short distance from the inner end of the shaft, and the half-disk G, mounted in the said slot and having the semicircle *g* cut from its center, as and for the purpose specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

FLETCHER HAWK.

Witnesses:

ELLA HAWK,

CAROLINE S. ADAMS.