

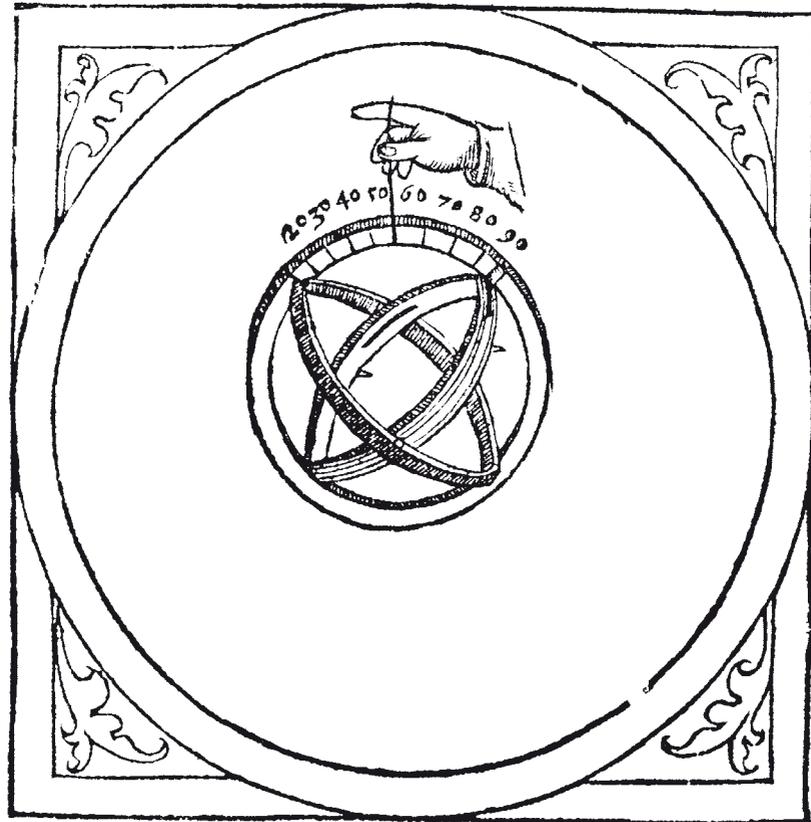
# Sun time

Description and use of the main types  
of sundial exhibited at the  
Musée d'histoire des sciences of Geneva

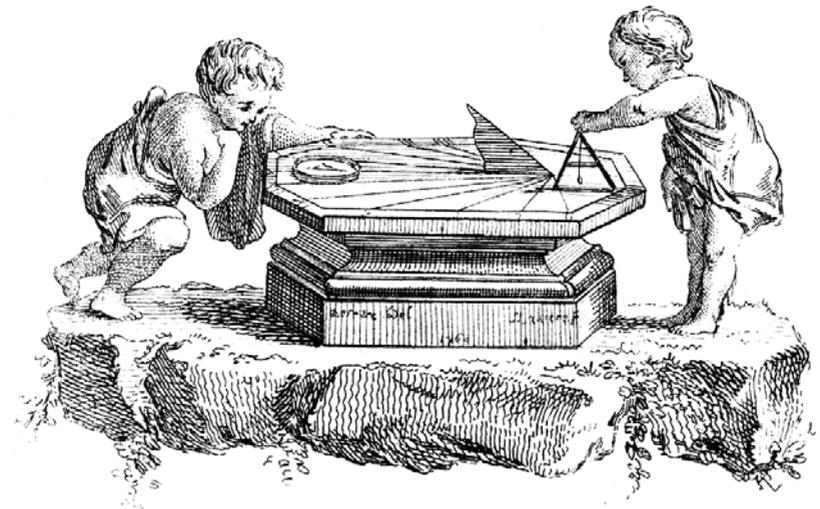


## Sundials

This booklet briefly describes the different types of sundial exhibited at the Musée d'histoire des Sciences of Geneva and the ways in which they function. Following their invention in early antiquity, sundials were constantly improved and many different types were developed. In order to read the time, some must be oriented in a north-south direction while others face the sun. Whatever the type, the hour is determined by the shadow cast by a fixed object (usually an inclined or horizontal axis) projected onto a surface marked with the hours or a table of times. One weakness of portable sundials was that they were generally designed to give only the local solar time.



*Usus Annuli Astronomici, Gemma Frisius, Cosmographia,  
Apianus, Antwerp, 1564  
Library of the Musée d'histoire des Sciences*



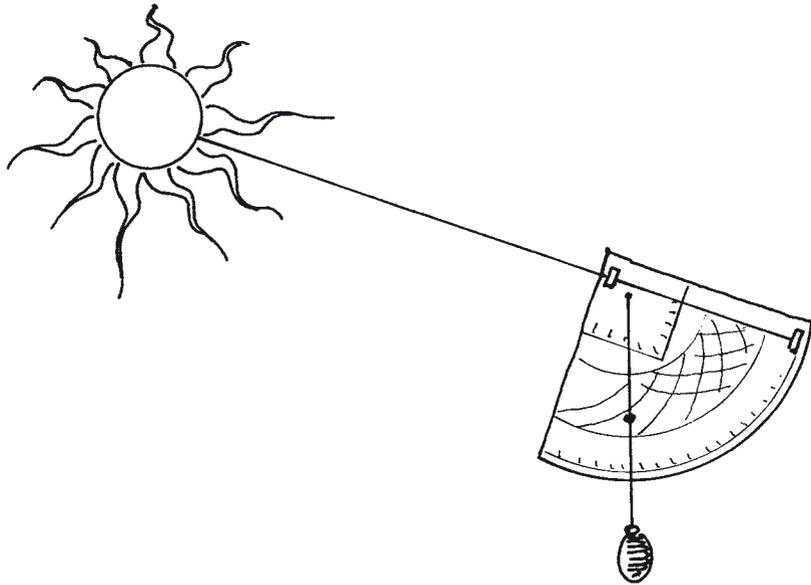
*Verification of the horizontal plane and orientation of a horizontal sundial  
Bedos de Celles, La gnomonique pratique, Paris, 1760  
Library of the Musée d'histoire des sciences*

*Cover: A gentleman using a quadrant  
after Lansberg, Verclaringhe ..., Middelberg, 1635*

## Quadrant

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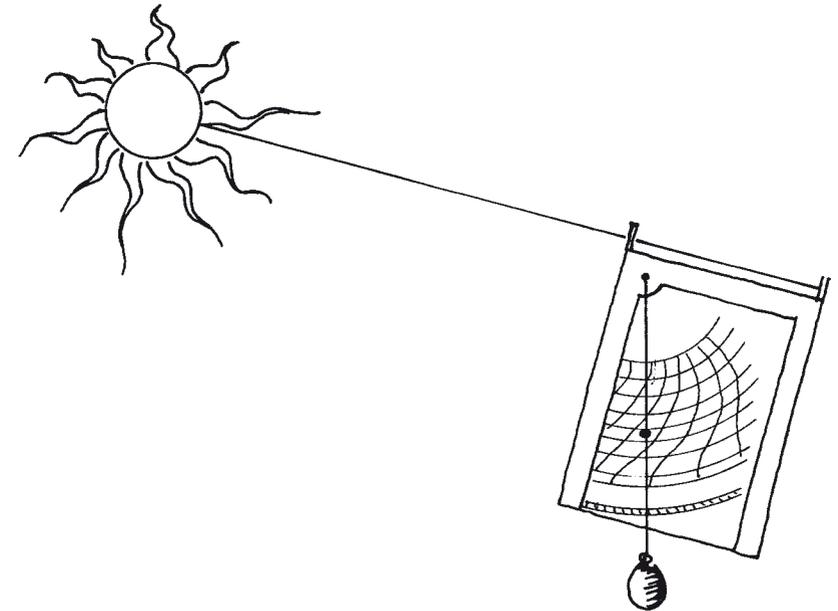
With its origins in antiquity, the quadrant is one of the oldest astronomical instruments. Amongst other features, it shows the time according to the height of the sun. Hour lines are engraved on the surface along with topographical and astronomical information. The hours are indicated by a bead which slides along a plumb line.



## Vertical sundial

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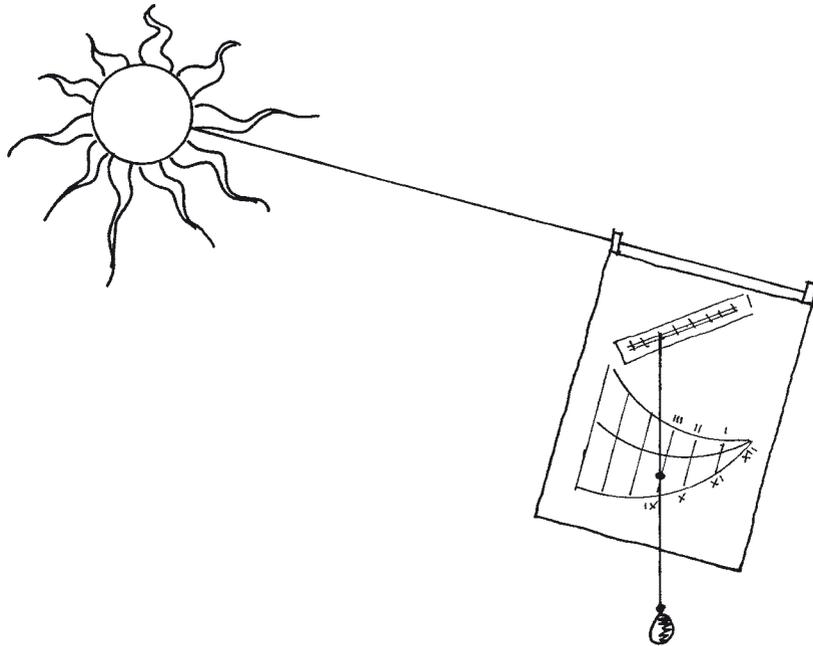
This sundial gives the time according to the height of the sun above the horizon and is aligned vertically. After adjusting the date with the bead by sliding it along the weighted line, the two **\*pinholes** are aligned with the sun. The time is shown by the position of the bead on one of the wavy hour lines engraved on the plate.



*\* Terms in bold are explained in the glossary p. 14*

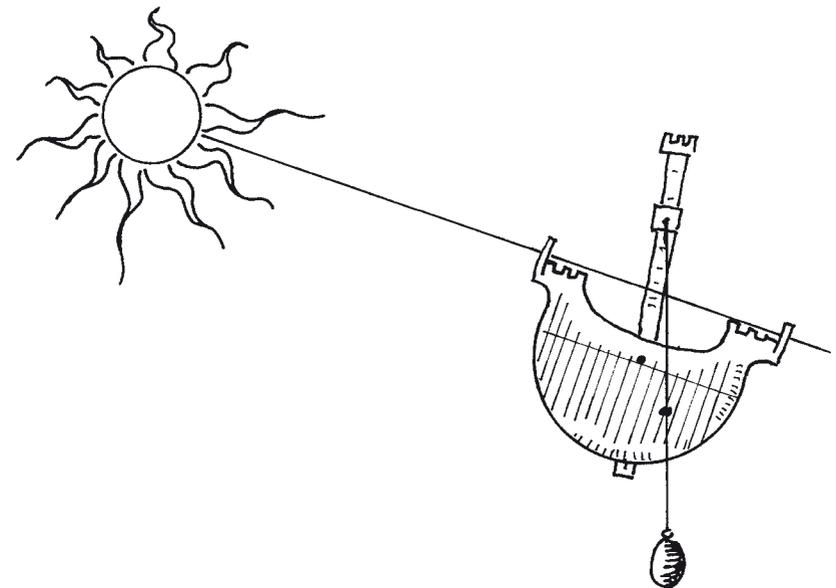
## Rectilinear sundial

Also known as the Capuchin (the type which operates on one **latitude** only) or **Regiomontanus** (those which operate across a range of latitudes) this sophisticated version of the vertical sundial shows the hours on parallel time lines.



## The "Navicula de Venetiis"

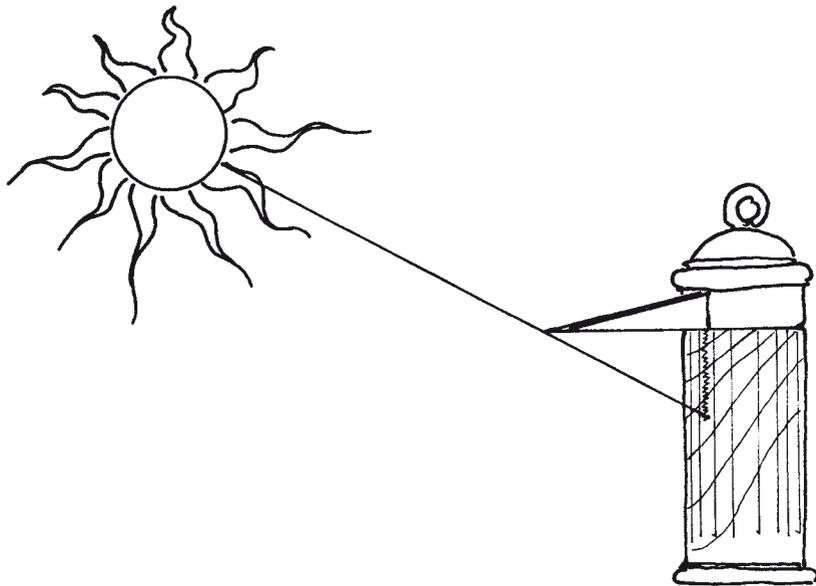
An ancestor of the rectilinear sundial this instrument shaped like a Venetian ship dates from the 14th or 15th century. It is used as follows: the cursor (the point where the plumb line is attached) is placed on the mast at the point corresponding to the **latitude** of the observation location. The mast is adjusted according to the **declination** scale. Finally, the bead is adjusted to the date. All that remains to be done is point the Navicula to the sun lining up the **pinhole sights** at the prow and stern on a ray of sunshine. The bead indicates the time on the straight vertical lines.



## Shepherd's sundial

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The shepherd's sundial determines the time according to the height of the sun in the sky. Very popular until the 19th century, this portable sundial closes like a penknife and offers the hour of the sun without pre-orientation to the **meridian**. In order to read the hour, the sundial is held vertically with the **style** towards the sun. The point of the shadow of the style falls on the hour-lines drawn on the plate. The shepherd's sundial has two faults: the date of the day of observation must be known in order to place the style in the right place and also whether the reading was taken in the morning or afternoon.

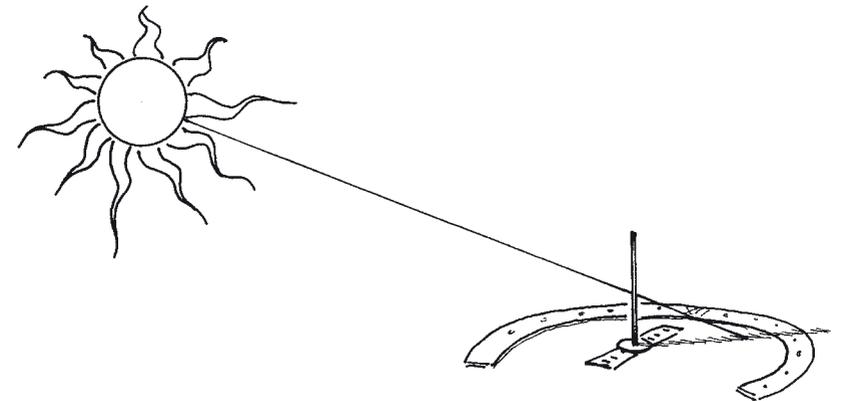


## Analemmatic sundial

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The analemmatic sundial or **azimuth** dial gives the hour by virtue of a vertical, horizontally mobile, **gnomon**. The gnomon is moved during the year on a date scale oriented north-south. It casts its shadow on a horizontal ellipse marked with a time scale.

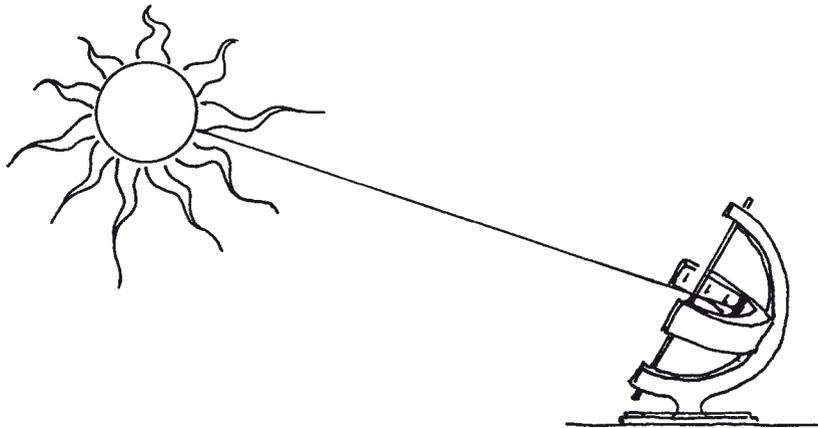
In geometrical terms, this sundial is none other than the **orthogonal projection** of an astronomical circle (see page 9) on the ground.



## Equatorial sundial

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The equatorial sundial must be oriented on a north-south axis before it can be used. Its **style** (the object which casts a shadow), placed parallel to the earth's rotational axis, projects a shadow onto a table of hours (a circular ribbon on the drawing), itself parallel with the **equator**. The table is divided into 24 equal sections corresponding to the 24 hours of a day.

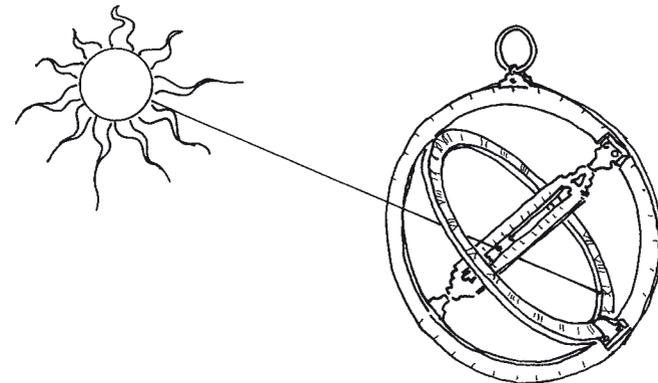


## Astronomical ring sundial

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This is a specific type of equatorial sundial. It is usually made of two metal circles and a small measuring ruler which can be folded together to form a flat disc for transport. The exterior vertical ring represents the **meridian** and is marked with **latitudes**. It is hung from a small suspension loop which is adjusted according to the latitude of the observation point. The second ring, perpendicular to the first, represents the **equator**. It is marked with 24 equally spaced hour points. Turning on its own axis, a so-called **declination** rule is equipped with a cursor pierced by a hole which is moved according to the date of the observation.

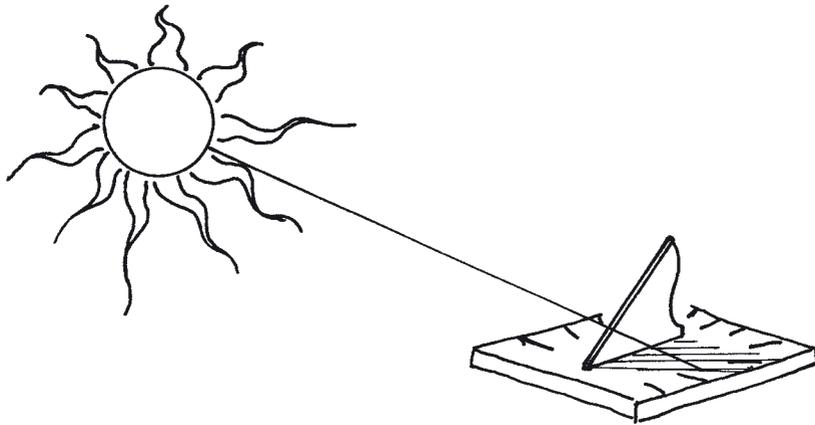
In order to read the hour, the instrument is held by the suspension loop in one hand and turned gently until a ray of sun shines through the hole on the rule and points to an hour-mark on the equator.



## Horizontal sundial

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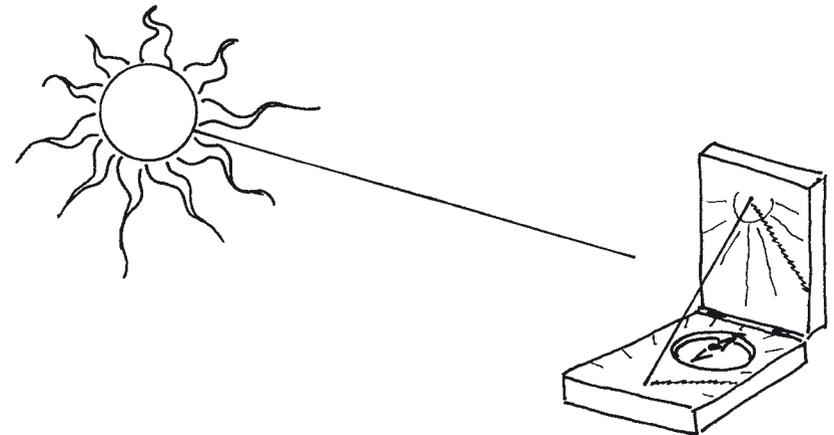
The horizontal sundial is oriented north-south before use. The **style** points towards the geographic north, parallel to the axis of the earth's rotation. The shadow of the **style** is projected onto the horizontal table. The angle of the **style** with respect to the table corresponds to the **latitude** of the observation point.



## Diptych sundial

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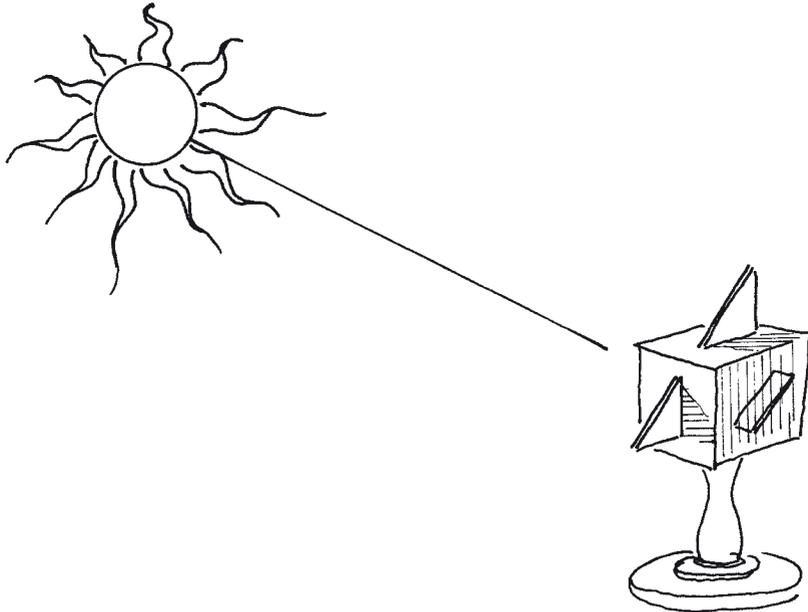
Very popular in the 17th and 18th centuries, this sundial has both a horizontal and vertical dial joined by a hinge. A taut cord acts as the **style** and joins the two dials when the instrument is open. In order to tell the time, the diptych is oriented with the help of a compass on the horizontal face. The angle of the cord corresponds to the latitude of the observation point. Some diptych sundials are equipped with several different fastenings which allow the cord to be fixed at different angles. They can thus be used at different latitudes.



## Multiple sundial

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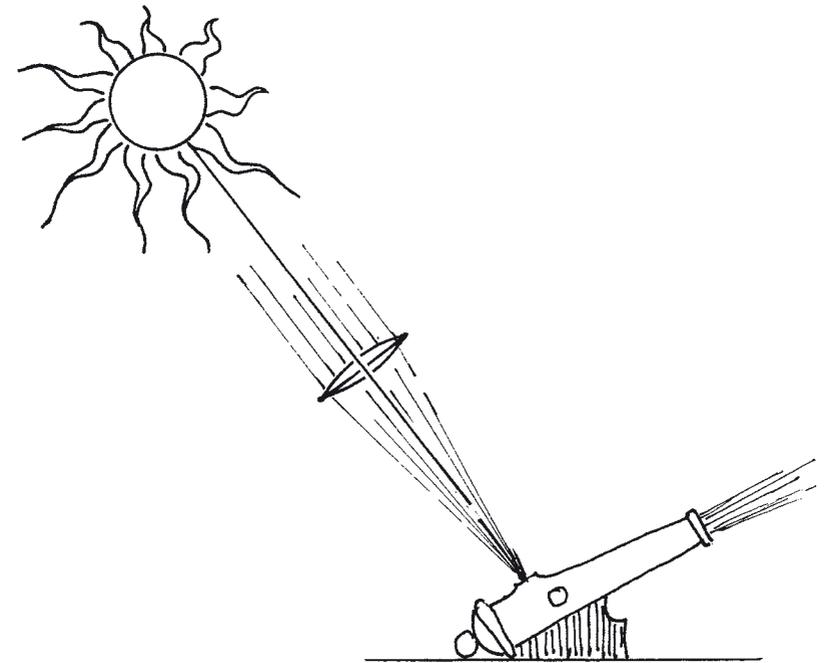
Sundial makers amused themselves by designing the multiple sundial which is more a collector's object than a practical measuring instrument. It is often in the shape of a cube with different types of sundial on each of its faces. When it is correctly oriented, the sundial indicates the time on each of them.



## Mid-day canon

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This miniature canon is designed to explode at the real mid-day, that is at the moment when the sun is directly over the local **meridian**. A magnifying glass is carefully positioned to concentrate the sun's rays on the detonator of the canon when the sun is at the height of its trajectory through the sky. In former times, the mid-day canon served to check the time on pocket watches.

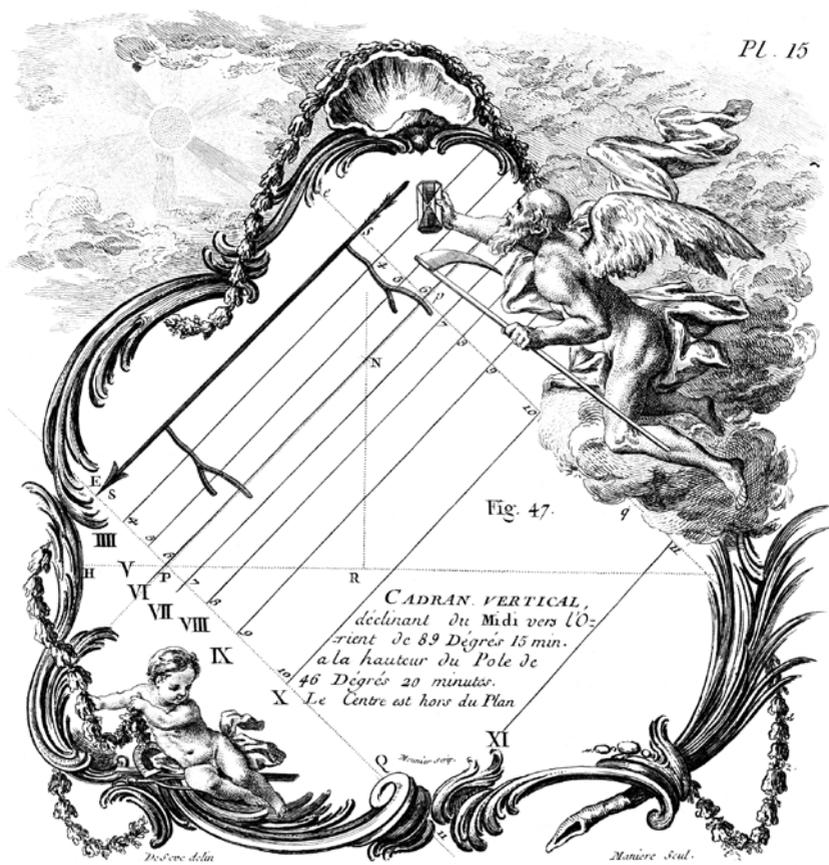


- **Azimuth:** the angle formed by the position of a star on the horizon in relation to the south.
- **Declination:** the angle formed by the sun in relation to the equator. The declination of the sun changes each day from  $-23^{\circ}27'$  (winter solstice) to  $+23^{\circ}27'$  (summer solstice) passing through  $0^{\circ}$  (the equinoxes).
- **Equator:** An imaginary line around the earth on which all points are equidistant from the poles. The equator divides the northern from the southern hemisphere.
- **Gnomon:** A vertical pole which casts its shadow on the ground. The gnomon has given its name to the profession of sundial construction, **gnomonics**.
- **Latitude:** The angle formed between an imaginary vertical line joining a point on earth to the centre of the terrestrial globe and the equator. It ranges between  $0^{\circ}$  to  $90^{\circ}$  N in the northern hemisphere and between  $0^{\circ}$  to  $90^{\circ}$  S in the southern hemisphere. With longitude, latitude is one of the two geographical coordinates which determines the position of places on earth.
- **Meridian:** The imaginary line on a vertical plane which divides the earth from the north to the south pole. In general, the meridian of an observation point is given by the geographical north-south axis.
- **Pinhole:** A small plate pierced with a sight-hole attached to a measuring instrument. Vertical sundials are equipped with them.
- **Orthogonal projection:** a method of representing a three-dimensional object on a flat plane by horizontal perpendicular lines drawn from different points of the object. This type of projection is widely used in technical drawing.
- **Regiomontanus:** A German astronomer, astrologist and mathematician (1436-1476), inventor of various astronomical instruments including the vertical sundial which bears his name.
- **Style:** The part of a sundial which casts its shadow onto an hour chart.

- Les cadrans solaires, Denis Savoie, Belin, Paris 1993
- Il était une fois le temps, Musée de l'horlogerie, Genève, 1997
- L'invention du temps, Jean Matricon et Julien Roumette, Explora, Paris, 1991
- Les instruments de l'astronomie ancienne, Philippe Dutarte, Vuibert, Paris, 2006



*Mid-day canon, Traité de physique, Ganot, Paris, 1860  
Library of the Musée d'histoire des sciences*



Vertical sundial, Bedos de Celles, *La gnomonique pratique*, Paris 1760  
Library of the Musée d'histoire des sciences

#### Other guides to the permanent collection available:

- Révolution(s) – A brief history of celestial measurement told through some of the astronomical instruments in the Musée d'histoire des sciences of Geneva. September 2011
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