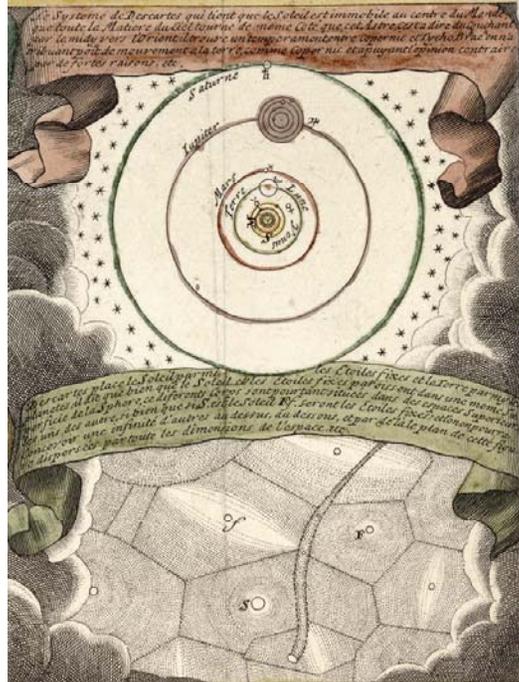
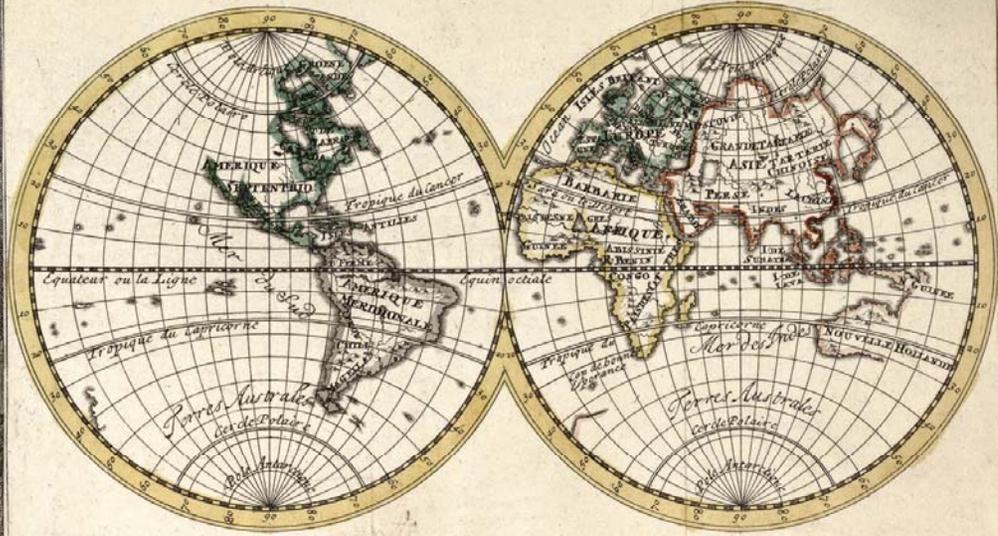




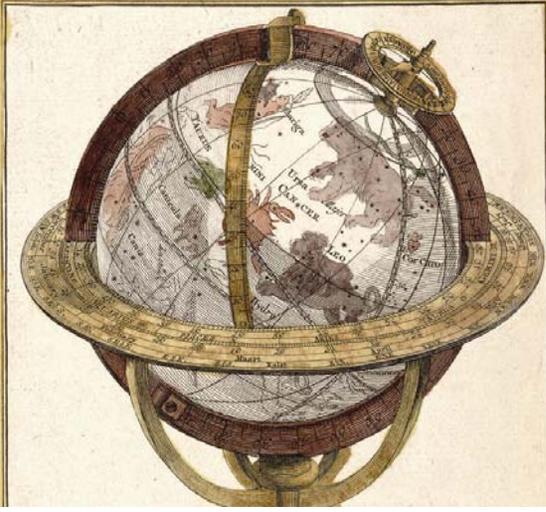
TICHO BRAHE, ET DE DESCARTES



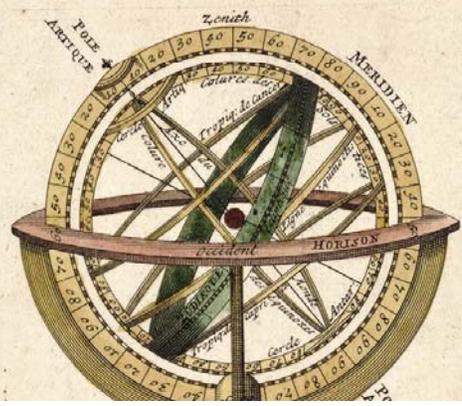
MAPPE MONDE OU DESCRIPTION GENERALE DU GLOBE TERRESTRE, SUIVANT  
M<sup>ode</sup> de l'Academie Royale des Sciences



DE HEHEL GLOBE.

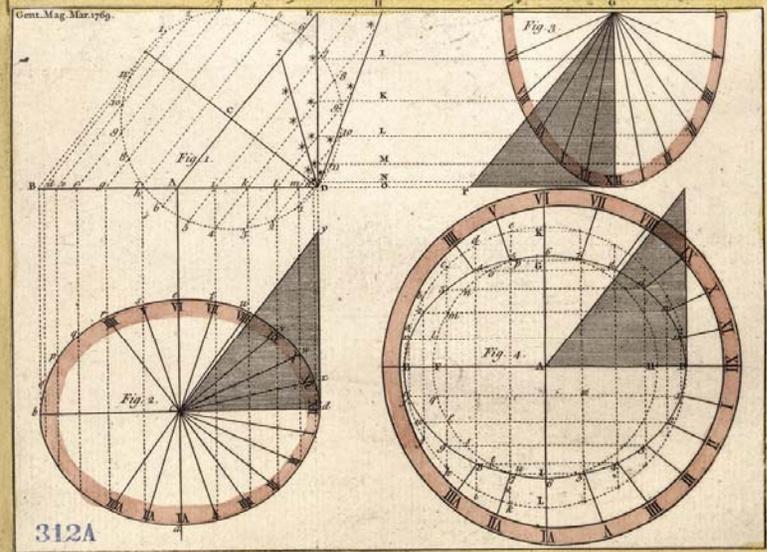


LA SPHERE ARTIFICIELLE





*A new method of constructing Sun-Dials,  
for any given latitude, without the assis-  
tance of Dialing Scales, or Logarithmic  
Calculations. By James Ferguson F.R.S.*



144 Ferguson's Method of constructing Sun Dials.

edge of the stile *cd*, that cuts the shadow on the time of the day.

The horary spaces, or angular distances of the hours on the dial, being thus found, there is no occasion for confining the hours thereon, or the lengths of the hour lines, within the ellipsis; for they may be produced beyond it to any distance, and the hour letters placed in a circle as in fig. 4.

A geometrical method for describing the whole or half an ellipsis will be shewn further on.

From fig. 1. continue out the horizontal line *BAD* to any length, as to *xii* in fig. 3. Then from the points *\*\*\** in the perpendicular *DE* (fig. 1.) where the parallel lines *57, 48, 39, 20, and 11* meet it, draw the right lines *H, I, K, L, M, N*, all parallel to the horizontal line *BAD* *xii*, producing them at pleasure, and, in fig. 3. draw *3 xii* parallel to *DE* in fig. 1. This done, take *CF* or *CD* (fig. 1.) in your compasses, and set off its length both ways from *G* (fig. 3.) to *v1* and *v1*, on the right line *EH* *v1 G v1*. So *v1 G v1* in fig. 3. shall be equal to *PCD* in fig. 1. and *xii G* in fig. 3. shall be equal to *DE* in fig. 1.

On *v1 G v1* as a conjugate diameter, and *G xii* as a semi-transverse diameter, describe the semi-ellipse *v1, vii, viii, ix, &c.* and to those points of it where the parallel lines *H, I, K, L, M*, and *N* cut it, draw the right lines *G v1, G vii, G viii, G ix, &c.* as in the figure; and they will be the true hour lines for an erect, direct south dial; and they may be produced beyond the ellipsis, and limited either by circular or square lines, between which the hours may be placed.

Lastly, draw *PG* in fig. 3. parallel to *ACE* in fig. 1. and *PG* will be the axis or edge of the stile *P xii G* for casting a shadow on the time of the day. And thus, by means of fig. 1. constructed for any given latitude, either a horizontal or vertical dial may be made for that latitude.

If you want a south dial to incline by any number of degrees, as suppose 16, draw the line *Dz*, making an angle of 16 degrees with the perpendicular *DE*, in fig. 1. Then *Dz* shall be the semi-transverse axis of the ellipse, and *Cz* the semi-conjugate; and right lines drawn parallel to *DP* *xii* quite through the semi-ellipses, from the points *\*\*\** in *Dz*, where it is cut by the parallel lines *57, 48, 39, &c.*

shall cut the semi-ellipses in those points through which the hour lines must be drawn, as from *G* in the upright south dial, fig. 3.

If you want to make a reclining south dial, draw the line *DH* (fig. 1.) making an angle with the perpendicular *DE* equal to the intended angle of declination, and produce *DH* and *CE* till they meet. From *D* to that meeting, will be the length of the semi-transverse axis of the ellipse, and from *C* to *6* the length of the semi-conjugate; which being found, proceed in all respects as above for the fourth upright dial.

To draw the ellipsis, and find the hour-points in it, observe the following method.

For a horizontal dial, as fig. 4. Make the radius *AK* of the circle *BKDL* equal to *AD* in fig. 1. and cross the circle at right angles by the two diameters *BAD* and *KAL*, and divide the circle into 24 equal parts, beginning at *B*. Connect these points of division, which are equidistant from *B*, by the right lines *af, bg, ch, &c.* all parallel to *KAL*, as in the figure.

Make the radius *AG* of the circle *FGHI* in fig. 4. equal to *CF* in fig. 1. and divide *FGHI* into 24 equal parts, beginning at *I*. Then through these points of division, which are equidistant from *I*, draw the right lines *7 5, 8 4, 9 3, 10 2, &c.* till they meet the former right lines, *ch, di, eb, &c.* in the points *7 5, 8 4, 9 3, 10 2, and 11 1*, on both sides of the diameter *BAD*; all which points are in the elliptical curve, and it is to be drawn through them, by hand, as in the figure.

And right lines drawn from the center *A* through these points in the ellipsis, will be the true hour lines for a horizontal dial.

To draw the ellipsis for a vertical south dial, make *DE* (in fig. 1.) the radius of the largest circle, and *CF* the radius of the smallest: the diameter of the former gives the transverse diameter of the ellipsis, and that of the latter gives the conjugate; which being found, construct the ellipsis the same way for the vertical dial as above shewn for the horizontal; then draw the hour-lines in the same manner, from the center or the axis, through those points of the ellipsis where the intersections of the cross lines meet it as in the horizontal; and the thing will be done.

Lastly, draw of each ellipsis which will give complete the equinoctial.

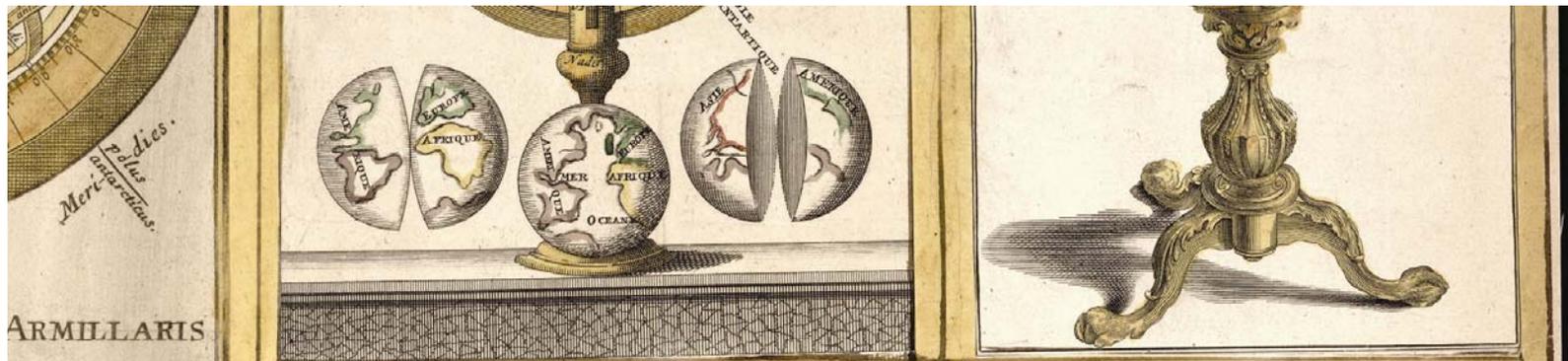
*AS* the usual In this fig marked *O*, *p* which is to be of another dial to a section poles, from *e* called a pole; style of this, other dials, *h* all parallel to other: The shewn in fig described, *th* to *Do*, and into 12 equal from the center to the line 4 angles with axis, the few lines, which that line.

This last is as the 2 when raised, tial plane, &c

All these together, as I have shewn which this figure perspective; where it is as the face dials, by the the axis *CD*.

To these 2 and a north made, as rep

In the cut *ll* to the *gnoman* *1, b* perpendicularly *a, b* and in *c d* will cast hour-lines, *v* of the quadr supposed *ra* line *IV XI* nodial plane *ver*al radii of they mark *th* parallels are of this dial



Draw lines through the center  
to all those extremities,  
and draw the hour lines, and will  
three dials, viz. AZ the  
A H the horizontal, and  
I-rect.

There is also a double line  
parallel to the style, or axis,  
be considered as the profile  
of the globe through the  
axis to west, and may be  
inverted.

The axis is the  
as well as of the circle  
at the hour-lines of it are  
to the axis, and to each  
manner of forming it is  
where a semi-circle is  
radius of which is equal  
its circumference divided  
into parts, and radii drawn  
through those divisions  
to S (which line is at right  
angles to the axis) these radii will  
represent the hour-lines of the  
dial drawn perpendicular to

The dial is on the same princi-  
ples, for the semi-circle,  
is parallel to the equinoctial.

Four dials may be joined  
represented at fig. 3, and  
if made such a model, of  
figure is an exact copy, in  
and placed it in a garden,  
vers the intention, by show-  
ing the hour on every one of  
the same style, or gnomon, viz.

may be added an east, a west,  
dial, all which I have also  
represented at fig. 4, 5, and 6.  
The dial the double line is pa-  
rallel to the axis of the globe, and the  
line, c, d, is to be raised per-  
pendicular to the VI o'clock line,  
that position, the top of it  
the shadows on the several  
which are found by means  
of a c VI. This, if it be  
fixed up on the equinoctial  
would represent the equi-  
noctial, so that producing the fe-  
lity quadrant to that line,  
the points through which the  
lines are drawn for the hour lines  
are N. B. The parallels

above are found by setting one foot of  
the compasses on VI, and turning the  
other from VII over to V, and from  
VIII to IV, &c.

The west dial is the east dial reversed,  
with the hours also marked the contrary  
way; so that the explanation of that  
will serve for this, *mutatis mutandis*.

The north dial is the south inverted,  
or turned upside down, and the figures  
reversed. I am, Sir, Yours, &c.  
J. H.

Canterbury, May 29.

