IWAN KAHN - USTER/SWITZERLAND (1999)
Amateur translation by Rudolf Hooijenga (11-2004)

Glass sundials

The sundial was the first instrument that permitted man to determine the time of day. Since its invention, hundreds of years ago, even the sundial has gone through enormous development. It was shown that the course of the shadow of a staff put simply into the soil resulted in no reproducible time determination. Only the knowledge of the exact movement of the earth around the sun permitted the building of sundials with minute-exact reading. Until the replacement of the sundial by the wheel clock, many sundials were built worldwide: at churches and buildings, in parks, as well as portable sundials equipped with a compass.

Today the sundial has lost its former value as a timekeeper, however it retained the philosophical, the inner worth. The continuous movement of the shadow reminds the viewer of the passing of his own time, and that the course of the sun and earth govern the course of events on our planet.

The sundial will always find its place as a decorative artisanal ornament.

Contrary to the earlier sundials, which were made from stone, wood, or metal, the author feels that now glass should be used! Glass as natural raw material offers special advantages for the building of sundials: Glass as optical element with lens effect, glass fibres as light-conducting elements, glass shaping in melting furnaces with the associated possibilities of transparency and colour.

In the following, five different kinds of glass sundials are presented:

The glass ball sundial.
The glass ball sundial with concentric half-ring.
Sundial based on concentric balls.
Sundial based on light-conducting fibres.
Sundial with shadow-throwing staff.

Glass ball sundial

Glass ball sundial: probably the simplest sundial in the world!

Fig. 1: The "sun circle" covers the hour lines 12h (&XII) and 11h (I) equally:
the current time lies in between, thus 11:30 h.

Since the ball is also a mirror, the sky is visible in the upper ball half; the environment under the ball in the lower!

The conventional sundial: A shadow-throwing staff and the shadow catching surface with the hour lines form the basic elements of the classical sundial.

However, it is not quite that simple! The shadow-throwing staff must be parallel to the axis of the earth, because only under this condition can the hour lines be calculated, referring also to location, direction, and shape of the shadow catching surface. Such sundials indicate therefore the time correctly only at the place intended for it. Moreover, it is not possible to switch from standard to summer time.

The sundial represented here is extremely simple. It consists only of a glass ball! The side towards the sun acts as a lens that bundles the rays and throws them on the back of the ball. There, a bright circular spot forms. This circular spot represents quasi the sun as it moves as a time pointer over the hour lines let in on this side.

The time reading is simple: The circular area touches or covers one or two hour lines, depending upon time of day. The centre of the circular area is easy to find, and this is the current time of day.

The ball holder is built in such a manner that the ball can simply be turned through one hour to go from standard to summer time. *Ball diameter: 12 cm.*

The glass ball sundial with concentric half-ring

The glass ball focuses the sunlight on the glass half-ring with annealed numerals that surrounds it. This light spot moves, in dependence of the position of the sun, along the time scale and so serves as a time pointer.

The metal parts are for aligning the sundial towards the south and according to longitude and latitude.
To finish the general impression, the sundial is built on a glass base.
Diameter of the glass ball approx. 150 mm.
This sundial weighs therefore several kilograms. (fig. 2)

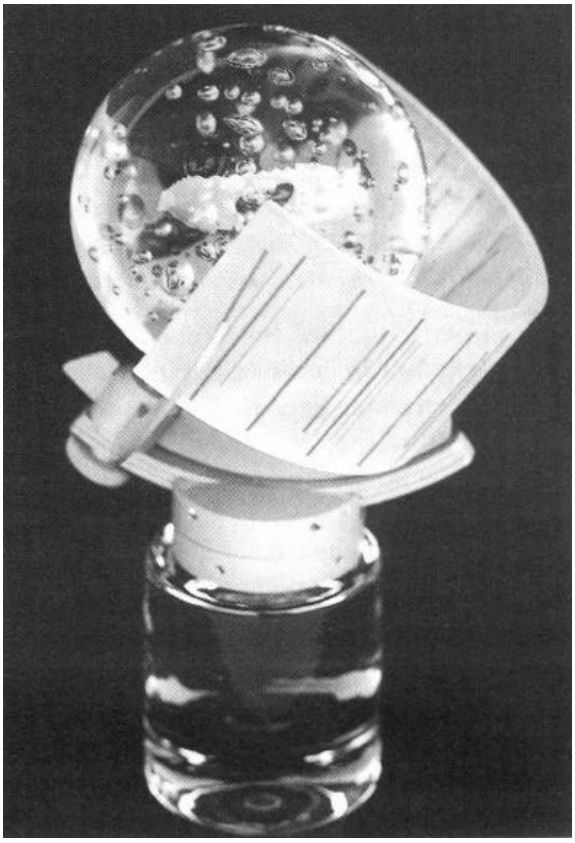

Fig. 2

Sundial based on concentric glass balls Pat.CH 667969-B5

The internal glass ball filled with coloured liquid focuses the sunlight on the surface of the outside glass ball. This coloured light spot serves as time pointer. It moves with the course of the sun along the time numerals. This path changes its height in the course of the months and so crosses the hour lines somewhat earlier or later. Each hour line has a section for every month. All sections together form an "eight". In this way, this sundial reads standard time.

Small table sundial

The instrument consists of two hand blown glass balls. Outside diameter approx. 10 cm. The time numerals are annealed using red glow heat. All metal parts are gilded.

The time reading takes place from the outside, or through the ball, or by the adjustable mirror.

The relatively heavy mirror serves also as a counterweight and provides for stability. The wood support accommodates the compass necessary to find the north-south direction. *(fig. 3)*

Fig. 3

Sundial based on light-conducting fibres
Pat. CH 55-2239

A cylindrical lens focuses incident sunlight to a fine bright line. This light line moves on the coaxially arranged half-ring in the course of a day from one end to the other.

On the half-ring, a multiplicity of light-conducting fibres is embedded over the entire length. The faces of these light conductors are turned to the lens. Only those light conductors that are straight under the light line receive light, while the others remain dark. The light conductors lead the light from one end to the other, like electrical current in copper wires. Each light conductor end is lead to a fixed point of the display and indicates the time as a bright point. Since the light conductors are flexible, the optics with the half-ring carrying the light conductors can always, for any place, be brought in the correct position for the sundial. The display can be placed in the position most favourable for the viewer.
So for example, the display area, a pane with the light conductor ends and time numerals, can be arranged as a colourful glass picture (say, a coat of arms) and then connected by the flexible light conductor to the optics. This arrangement permits the building of window-sundials that can be made to read correct time at any sun-irradiated window.

The separation of light receiver and display section (pane) allows much liberty to the design of the pane in all aspects. Such panes can be executed in classical glass painting technology, or using the modern glass-fusion process.

"Light conductor window sundials”

Classical glass painting: Cathedral glass, special hand-blown glass treated through cutting, etching away undesired glass layers, repeated paints with black leadpaint, repeated annealing at red-glow heat, leadening… Depending upon subject this is quite a high expenditure, which leads however to extraordinarily beautiful results. (fig. 4)

Fig. 4

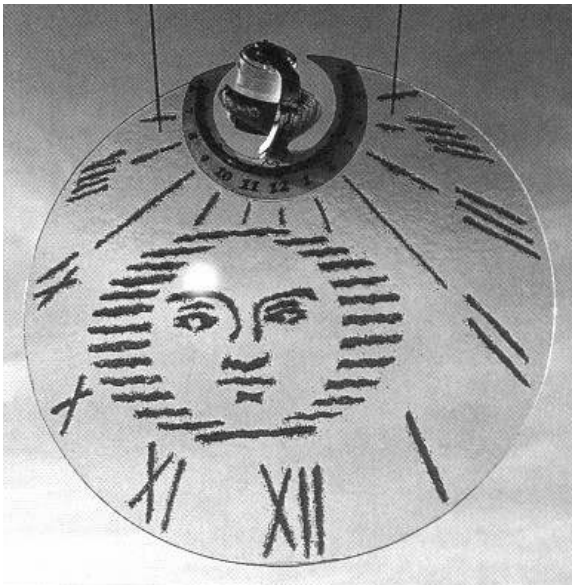

Fig. 5

Disks manufactured by glass fusion:
On two base plates of compatible glass, further pieces of glass are placed and melted at suitably high temperatures more or less deeply into the base plates.

"The sun", *diameter approx. 30 cm (picture 5)*

Glass sundials with shadow-throwing staff

The glass body of these sundials is melted in a fireproof mould in the furnace: The fireproof mould results from casting the model of the sundial with a gypsum-similar mass. The mould is filled with glass granulate, which determines colour and transparency. The filled mould goes through a burn cycle in the furnace, up to approximately 850 degrees centigrade (1550 Fahrenheit). After cooling, the mould is destroyed. The glass body must now be cut and polished. Then the time scale and the shadow staff are fixed in place.

Such sundials are particularly beautiful when illuminated by the sunlight, because the glass, interspersed with innumerable fine vesicles, appears brilliant and the shadow line is well visible as it slides over the time scale.

The sundial is suitable for garden or for desk.
Dimensions:
"angular" sundial,
approx. 14 by 14 by 7 cm, approx. 2 kg glass
"round" sundial,
Diameter approx. 14cm, 7 cm deep. (fig. 6)