The Equatorial Sundial At *Frankfurt am Main*, Germany

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Introduction

Monumental sundials may be little more than picturesque garden ornaments to some people, but for the more sensitive spirits among us, they are captivating scientific works and nostalgic reminders that for thousands of years, the fundamental time pattern for human beings was the Earth-Sun relationship. This article is a brief description of the monumental sundial located at the *Nizza Park* in Frankfurt, Germany, on one side of the *Main* river (Fig. 1). After two years of intensive work, the Frankfurt sundial was finally concluded in April 1951, according to the design of Lothar M. Loske who, at that time, was professor at a university in Wiesbaden, Germany (refs. 1, 2). This was indeed a feat for which an admirable combination of artistic skill and technology was required. The equatorial sundial was donated to the city by the company *Vereinigte Deutsche Metallwerke A.G.* It was the most precise and complicated sundial on earth (refs. 3, 5). The construction was in the charge of Walter Haase. All of the small pieces contained in the copper sphere, which weighs more than a ton, were made by hand. Leaving aside the theoretical calculation and design, more than six thousand hours of work were invested in the creation of this sundial. Although its design belongs within the equatorial category, the variety of indications it provides makes it far superior to most monumental sundials around the world. Its spherical form, achieved by means of a series of rings much like the old armillary spheres used to determine the position of the stars, greatly enhances its overall appearance and makes it a beautiful open-air monument.

Brief Description

The main ring, positioned parallel to the equatorial plane, is 3.45 meters in diameter, having the twelve stylized signs of the Zodiac represented in their correct positions with regard to the heavens. This ring supports the main face, which due to its considerable size, allows the time to be read with a precision of a few seconds! The minute lines are sufficiently far apart to permit the movement of the shadow from one mark to another to be appreciated. Observers are

Figure 1

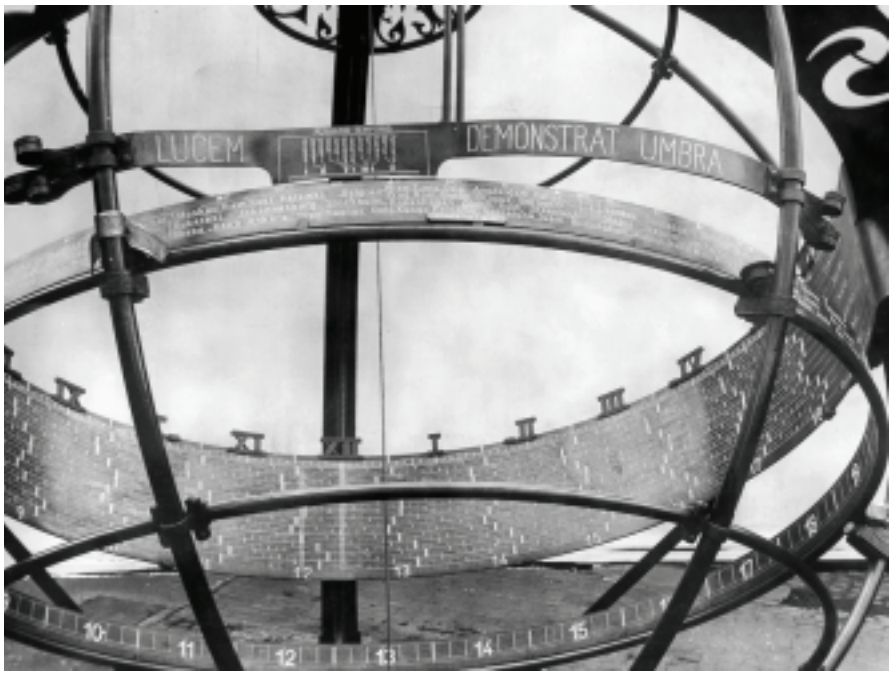

Figure 2

invariably impressed by this feature, since they can literally witness the passage of time. As can be seen in Figures 1 and 2, the gnomon is a thin wire tautened from one pole to the other. The rosette at the upper part of the sundial is an artistic representation of the four seasons. On the lower part, the rosette is supposed to represent the Earth's rotation.

The upper Roman numeral scale on the main face shows true solar time in Frankfurt. Minutes are shown by a narrow, graduated band. By taking into account the time equation represented by the analemma underneath the number twelve, it is possible to determine noontime according to mean solar time. Likewise, by using the time equation values, it is also possible to determine mean solar time for the other hours of the day.

The Arabic numerals on the lower edge of the main face show true solar time for the 15º meridian, east of Greenwich, which was selected to determine legal time in Germany. Since the geographical position of the sundial, 8º40' eastern longitude, does not coincide with the meridian, there is a difference of 25 minutes and 20 seconds between true solar time in Frankfurt and true solar time at the eastern 15º meridian, as shown by the Arabic numerals on the main face. The time equation values for each month, corresponding to the time at the meridian, are shown by the twelve bands stretching across the main face. The upper band of this scale corresponds to January, with the other months

Figure 3

represented below. The most exceptional feature of this sundial is that it provides legal time.

If for example on January 1 an observer's wristwatch reads 12 o'clock (legal time in Frankfurt), the vertical lines above the Arabic twelve, or in other words, the time equation, will show that it is 3 minutes and 22 seconds before the true midday on the eastern 15º meridian (legal time) and 28 minutes and 42 seconds before the culmination of the Sun in the zenith, indicating true midday in Frankfurt, or 12 o'clock in true solar time. Another interesting feature of this sundial is that almost at true midday, two parallel shadows may be seen at the center of the dial. Exactly when the Sun reaches the meridian, the shadow of the main gnomon appears between them, but only during a few seconds, indicating the precise moment of the true midday at Frankfurt.

Appearing on the outside of the smaller ring, located below the main face, are the names of 200 cities, listed according to their geographical location (Fig. 3). This ring may be turned manually so as to show true solar, mean solar or legal time in each of the cities. This is done by aligning the mark of each city with that of the month corresponding to the day on which the observation is made and consulting the scale bearing the phrase *Lucem demonstrat umbra*. In fact, the three kinds of time may be determined for any place in the world, as long as the geographical longitude and the meridian governing legal time are known. A more detailed description of this sundial can be found elsewhere (refs. 4-7). As in most sundials designed by Lothar Loske, all descriptions are in Latin (i.e. *aequatio temporis*, *temporis solaris*, *quindecim gradus*, *etc.*)

Conclusion

As we all know, there is in principle one area in which sundials cannot be surpassed by any other type of clock, whether it be a precision chronometer, an electronic, quartz or even atomic clock. Depending on the system utilized, all chronometers and other such devices that we call clocks are able to keep the time to which they are adjusted with a greater or lesser degree of precision. Nevertheless, none of these clocks is able to determine time by itself. This is a unique capability of sundials, which also explains why they were still used at the end of the 19th century, despite the availability of mechanical clocks.

As the product of inspiration, art frequently exceeds the limits of logic. Nonetheless, the sundial presented here incorporates the laws of gnomonics, allowing a certain logic of form and function to prevail, so that ancient styles, technical knowledge and even abstract notions are enhanced by the harmony achieved among the different elements. Even nowadays, half a century after Lothar Loske began with the design, the sundial at *Nizza Park* represents one of the main attractions of Frankfurt.

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