Show-piece at one of our leading watchmakers and jewellers:

A WORLD TIME CLOCK AND PLANETARIUM

A few weeks ago, a clock of considerable interest, both to the layman and the technician, was installed in an outside show case at one of the finest shops in Zürich.

This clock was designed by an engineer, Lothar M. Loske, and its construction was carried out in the workshops of the firm of Türler & Co., Zurich.

The clock (Fig. 2) is set in a wall and protected by a glass front. There are two circular dials, 48 cm in diameter ; these constitute a clock which gives the time in all time zones, and a planetarium—that is to say, a small-scale representation of the solar system. On the sides of the clock there are two engraved plates giving information in German and English.

Certain parts of the dials are made of distinctively coloured Perspex ; the upper part is coloured red, gold and black, and the lower, blue, gold and black.

Motive power is received by two anchor type slave clocks (the minute hand advances in steps), and by a synchronous motor. The magnet of the movement driving the planetarium is somewhat stronger than that used for the time-of-day clock.

A group of additional wheels were added to the motion work to obtain Zurich legal time ; a reduction ratio of 24 : 1 is used. This mechanism rotates a Perspex disc in a left-handed direction ; the disc carries figures from 1 to 24.

The numbers of revolutions made in 24 hours by the various parts are as follows :

Anchor :	480
Minute Hand :	24
Disc with the 24 hour mark :	1
Seconds Hand :	1440
Hour Hand :	2

Fig. 1. Both laymen and technicians have shown much interest in the world time clock and planetarium, which has recently been installed at the front of the premises of A. Türler and Co., Paradeplatz, Zurich.

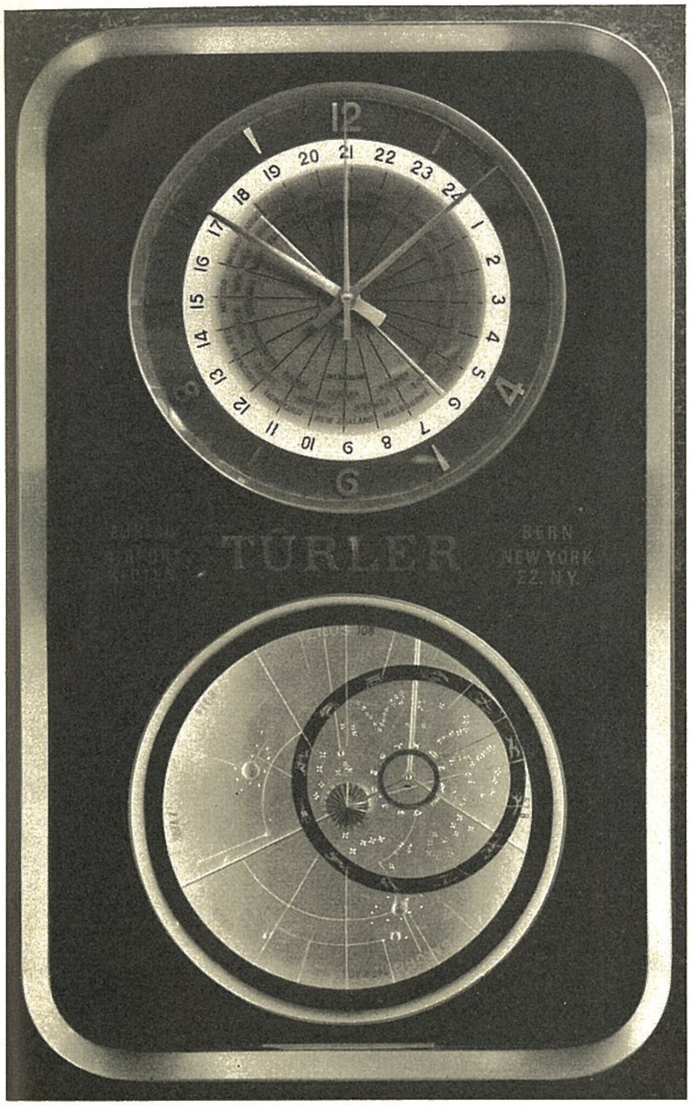


Fig. 2. The clock was constructed according to designs by Lothar M. Loske ; it has two circular dials, 48 cm in diameter. It gives the time in all the Earth's time zones, together with a small-scale representation of the Solar System.

The motion of the seconds hand is continuous, and its position is corrected at each minute by a special mechanism.

The *planetarium train* (Fig. 3) consists of 40 wheels and 4 pinions ; these are mounted on a common arbor, and give a reduction of 43 554 720 to 1. This enormous number of rotations of the anchor takes 2 million hours, i.e. the time of one orbital rotation of the planet Pluto.

To obtain an awkward reduction ratio of this kind it was necessary to carry out some *lengthy calculations*, as it was essential to reduce the number of wheels required as far as possible, at the same time keeping the numbers of teeth in each wheel within reasonable bounds ; this is complicated by the obvious fact that one cannot have fractions of a tooth ! The numbers of teeth were determined by the method of continued fractions. Figure 4 shows the schematic arrangement of the wheels in the planetarium train.

If one uses relatively small numbers of teeth it is impossible to avoid minor errors, but these are negligible in this application. For those planets with a time of orbital rotation of less than ten years, the error is of the order of one second. This error reaches a complete day in the case of the planet Pluto but one should bear in mind that its period is 248 years or 90 520 days.

The design of the mechanism offered a certain amount of difficulty as regards the sizes of the wheels (modules), centre distances, directions of rotation and the fact that they are all mounted on a single arbor. The manufacture of the wheels called for a certain amount of ingenuity, since the numbers of teeth in certain of them are prime numbers. Five different modules were used. The stepped pipes for mounting the hands may be seen in Figure 2 ; provision is made for representing the motions of the nine planets— Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.

The dial of the world time clock

The central disc carries the name of 36 places or regions, while the outer part of the dial is divided into 12 hours, with minute or second sub-divisions, to show the legal time in Zurich (Fig. 2). The radial lines running from the centre of the dial represent meridian lines on the Earth ; thus, the angles between them are angles of longitude, and between two consecutive lines there is an angle of 15°, or 1 hour, starting from the Greenwich meridian.

These radial lines represent the divisions of the time zones.

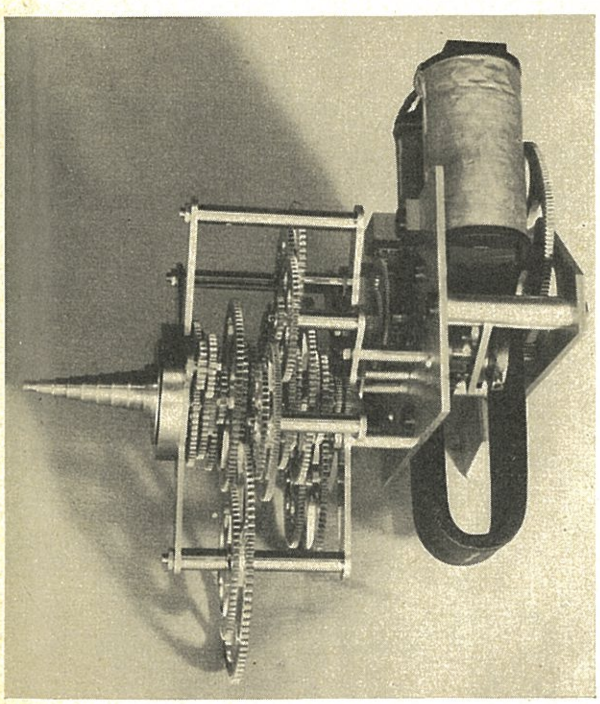
The names of the principal cities are inside and slightly behind a smaller circle which bears the figures from 1 to 24. This circular ring makes one revolution in 24 hours in an anti-clockwise direction ; thus the numbers indicate the legal time in the city facing that particular number.

The starting point for the determination of legal time has been fixed by international agreement : the international meridian is that which passes through Greenwich Observatory.

Places to the east or west of this meridian have, with few exceptions, a legal time which is ahead of, or behind, Greenwich time by a whole number of hours, according to the time zone in which that particular place happens to lie. Longitude 180° from Greenwich, might be said to be either east or west ; this meridian constitutes the international date line.

If, on a certain Sunday, the clock indicates that it is noon in London it will be 6 p.m. at that instant in Calcutta, and in Auckland the last minute of Sunday will have passed, and Monday begun. On the other hand, in Midway Island (longitude 165° W)—i.e., one hour away from the international date line—it will still be the first hour of Sunday.

To avoid overcrowding the dial, only a few names have been included ; it goes without saying that the time in London has been adopted by all countries using Western European Time.



Paris uses Central European Time, and the same is true of Zürich ; thus, legal time in Zürich is the same as that in Paris, as indicated by the position of the hands on this world time clock.

At a given instant, the name of a certain locality appears in a dark zone if it is night, or in a bright zone if it is day. The hours of daylight are taken to be between 6 a.m. and 6 p.m. on this clock.

The *planetarium indications* appear on the lower dial. The motions are carried out by 12 Perspex discs mounted one behind the other, so that the representations of the planets appear to float in space instead of their being mounted on hands or cranked rods, as is often the case in astronomical clocks fitted with a planetarium.

The first disc is stationary, and has at its centre a large representation of the Sun. The rim of the disc is divided into 360° against a blue background ; the numbering of these divisions is done in such a way as to take into account the fact that all the planets move to the left. Each planet is connected with the divided circle by a radial line ; this indicates the angular position of the planet at any instant measured from the sun.

To simplify the planetary system in this small clock, arbitrary scales have been chosen for the orbits, the distances from the Sun, and the dimensions of the planets themselves.

The orbit of a planet is elliptical, if one does not take into account the perturbations caused by neighbouring planets ; the sun lies at one of the foci of the ellipse. In this clock the orbits are considered circular, and this evidently results in a small error in the position of the planet.

The distances of the planets from the Sun are so great that they would barely be perceptible, owing to the actual size of the clock. The true distances (mean values) are inscribed on the rim of the disc immediately after the name of the planet. The distance figures are in millions of kilometres. The name and number—for example, Saturn 1428—rotate around the Sun.

Fig. 3. The planetarium train consists of 40 wheels and 4 pinions ; these are mounted on a common arbor, and give a reduction of 43 554 720 to 1.

SCHEMATIC DIAGRAM OF PLANETARIUM TRAIN

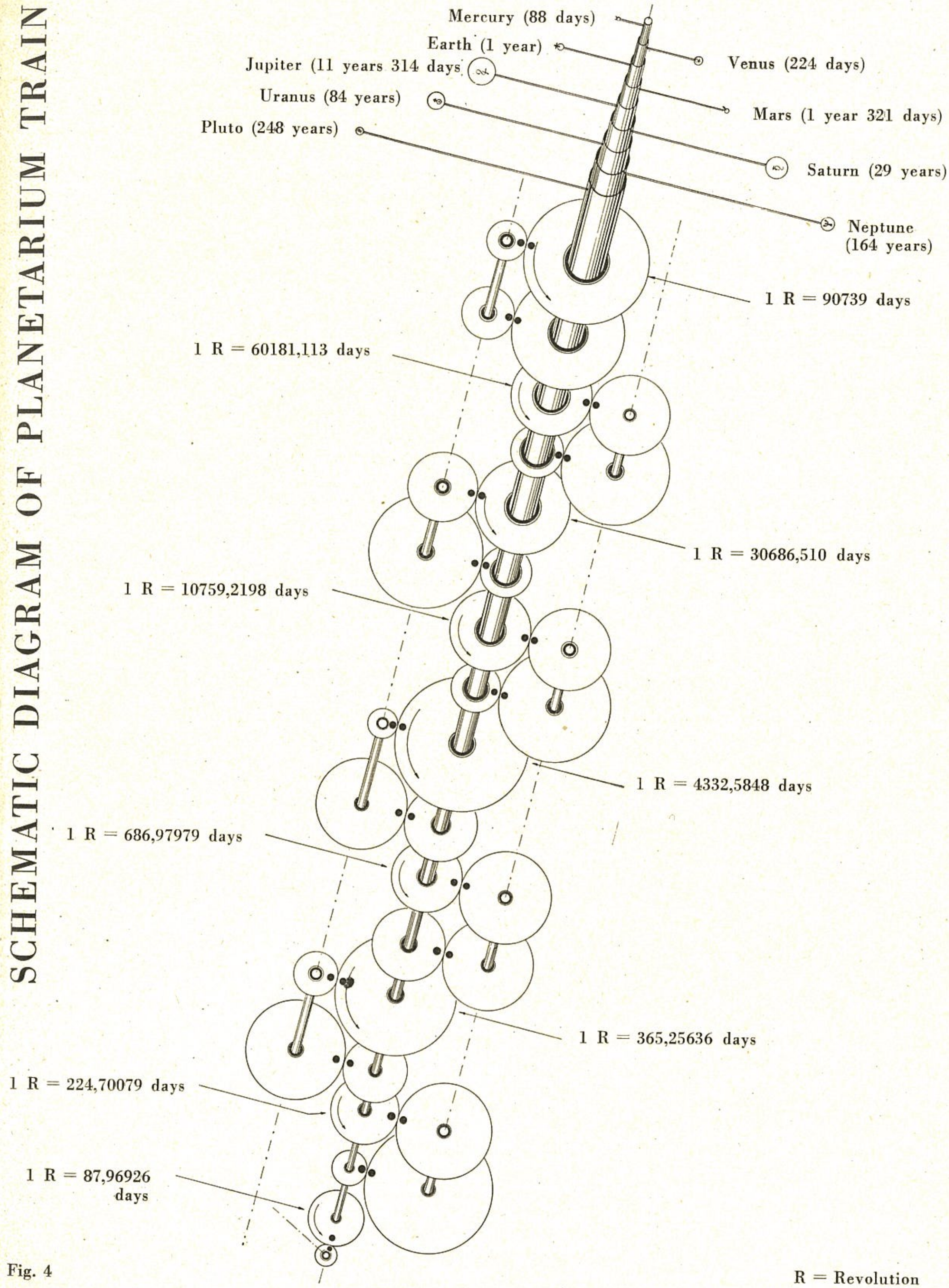


Fig. 4

R = Revolution

The relative sizes of the planets differ, in reality to such an extent that if they were represented true to scale the clarity and usefulness of the clock would be compromised. If the Sun were given a diameter of 1.2 m Jupiter, the largest of the planets, would have a diameter of only 13.6 mm. The Earth would be 1.1 mm, and Mercury 0.5 mm. To represent Pluto at a distance corresponding to the sizes mentioned above it would require a planetarium 590.4 mm in diameter.

The times of rotation of the planets in their orbits, as obtained from the gear train, are as follows :—

Mercury 88 days
Venus 224 days
Earth 365 days 6 hours
Mars 686 days
Jupiter 11 years 314 days
Saturn 29 years
Uranus 84 years
Neptune 164 years
Pluto 248 years

The Earth occupies a special position among the 9 planets in the solar system. It is located at the centre of the Zodiac disc and the constellations of the Zodiac ; this disc is also divided into 360°, thus enabling one to see the positions of the other planets and the Sun as they would appear to an observer on the Earth.

The difference between the heliocentric and geocentric positions of a planet can readily be observed in Figure 4 ; this refers to the planet Venus. If one follows a line from the Sun to Venus and then on to the outer divisions, one may read off the heliocentric position of Venus as 7.5° ; the line joining the Earth and Venus gives an angle of 71° on the divisions of the Zodiac circle ; this is the geocentric position of Venus.

The Zodiac circle turns eccentrically about the Sun ; it makes one revolution in each year, and during this time all twelve signs of the Zodiac will have passed by. Inside the black, sunk Zodiac ring, are certain constellations having the same relative position to the ecliptic and the Sun, bearing the same names as the Signs of the Zodiac, but without having the same significance. About 2000 years ago, the part of the ecliptic bearing the name of Aries was, in fact, in the constellation of Aries. Today, however, the sign of Aries, « The Ram », is in fact in the constellation of Pisces (the first point of Aries is the starting or zero point of the divisions ; it is the vernal equinox, which marks the beginning of Spring). In astronomy, this displacement of about 30° is known as a twelfth of the « Platonic Year ».

The illumination of the clock is by neon lamps ; the free space in the upper dial is illuminated with a reddish light, while the lower dial has a bluish illumination. The planetarium train is covered by a window.

N E W M O D E L S

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«Miss» models

Universal of Geneva, renowned as one of the innovators of horological style, has created an ultra-stylish watch, whose 18ct. gold bracelet is fashioned according to a new technical process based on the elasticity of gold.

For movement this watch has the 6‴ 106 created by Universal, appreciated alike by the public and by watchmakers because of its noteworthy technical qualities. The richly-chased dial is protected by an unbreakable white sapphire glass which increases its legibility.

These creations are available in several registered and patented styles, and will doubtless meet with great success.