AN ASTRONOMICAL CLOCK WITH AN AUTOMATIC ADJUSTMENT OF TIME AND CHURCH CALENDAR.

BY CHARLES A. BRASSLER.

Be it ever so simple, there is a certain fascination about a clockwork which cannot fail to rivet the attention. That with a spring or a weight and four wheels the period of time between sunrise and sunrise called a day can be divided into eighty-six thousand four hundred exact parts, and this subdivision be repeated indefinitely, is certainly most astonishing and very near akin to a miracle. And yet this is the simplest duty of a clock. Those of us whose qualifications adapt them to extend their observations to the phenomena of nature other than the passage of time, find that certain events occur and constantly recur with marvelous exactness. Mechanical minds are not content with knowing this; they are impelled with a desire to indicate the changes mechanically, and some of the more daring ones reach out to the prediction of the events far into the future centuries.

Having once acquired the knowledge and skill necessary to subdivide one of the smaller periods of time, a day, into its parts, the rest is simply a matter of computation; for, with slight variations which have been discovered, the other events follow successively in regular order and at tolerably regular periods. What mechanism could be conceived, then, which would mark off these occurrences with equal precision to the clockwork, wherein it is possible to cause a wheel to revolve once a minute or once in four years? The phenomena of nature are such daily events as the rising and setting of the sun, of the moon, the ebb and flow of the tides, the longer periods of the seasons, the spring and the neap tides, the church holidays and festivals, the regular yearly revolution of the earth about the sun, the precession of the equinoxes, and with reference to our sphere the movements in their respective orbits of the planets and stars.

Clocks which show all these are called astronomical clocks. Such a clock we are now about to consider, and from the number of these events which it records, and the method by which it does it during a long period of time, correcting automatically the errors which occur in the advancing years, it is entitled to rank among the wonderful productions of the human brain and hand.

Our illustration depicts a highly ornamental clock constructed by Mr. Ernest Weber, a horologist in Georgenthal, Thuringia. By the aid of an armillary sphere, it displays the apparent courses of the stars visible to the unaided eye, combined with some of the phenomena which attend them; it moreover regulates a continual Gregorian time and church calendar (*Computus ecclesiasticus*) as well as a so-called perpetual calendar.

The mechanism is driven by a spring with a winding period of nine days. The escapement, which is plainly visible just above the seconds dial, is a chronometer escapement with a compensated balance vibrating under the influence of a spiral cylinder-shaped spring. Besides this, the case contains a striking work for the hours and an alarm of the same winding period.

With reference to the data in the calendar, be it said that the day of the month changes suddenly every day at midnight, while the name of the month and the week day have an uninterrupted but slow motion. In order not to demand too much power from the main spring at one time, those fixed dates, which remain unaltered through the course of any one year, change successively during the twenty-four hours devoted to December 31 of the closing year, and in such a manner that all the data for the new year are in position and visible at its opening.

To effect these changes more quickly by the aid of the striking work, and at the stroke of twelve midnight, as is the custom with similar clocks, has been avoided here, for the reason, as we shall see later, that it is often desirable to disconnect the sphere movement from the regular clockwork, in order to set it upon some past or future dates; thus all the calendar data, and particularly the festival of Easter, must be capable at the change of the year of moving themselves either forward or backward, which could not be effected if they were attached to the striking mechanism.

AN ASTRONOMICAL CLOCK

that indicates the apparent course of the stars, Gregorian time, and astronomical time, besides including a perpetual calendar.

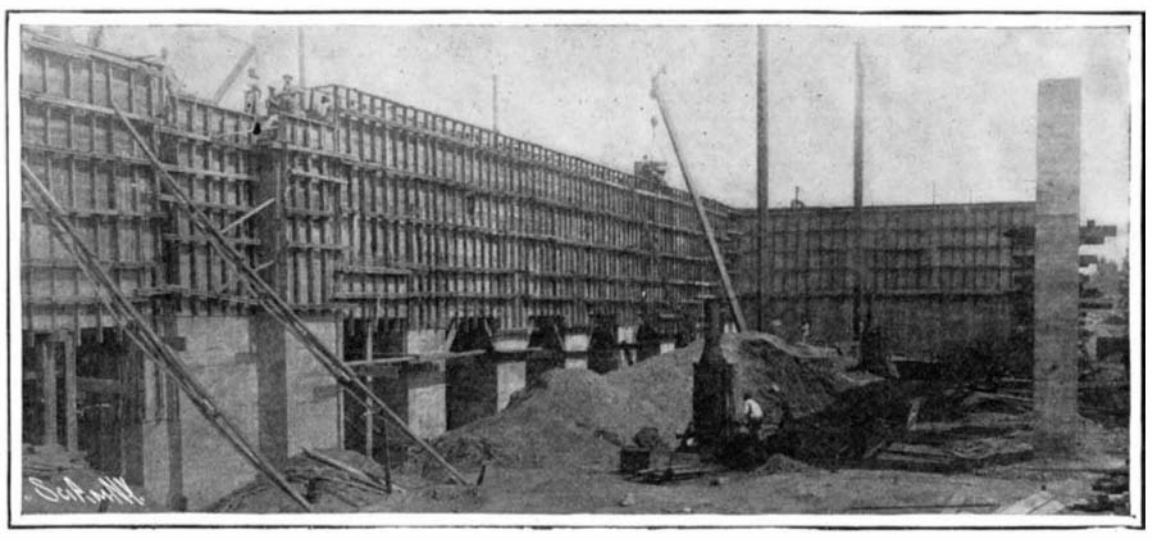
Though it may be unnecessary, we shall further remark that it is not necessary to change the monthly indicator for months of uneven length, for the clock does this for itself, as well as inserting the intercalary day every fourth year, as also the intercalary day every four hundred years, so that the year 1900 appears as a common year, while 2000 is a leap year, and again 2100, 2200, and 2300 are successively common years. The casing of the clock is a hollow cube of 34 centimeters in height and 27 centimeters in width and depth resting upon four compressed balls for feet. It is provided with a plinth both top and bottom, which is enameled in white and ornamented with gold. Within this compass is contained all the movement of the clock proper, the striking work, the alarm, and the transmission to the globe above. The four sides of the cube are formed of plate glass, behind which the different dials for time, calendar, and holidays are visible. Upon the front, shown in the cut, are seen the following: the date of the current year, stating as to whether it be a common or a leap year, showing February with 28 or 29 days, also the month, the day of the month, the name of the week day, and the day divided into daylight and darkness. Upon the main dial are seen the hours and minutes, divided into the customary twice twelve hours, with the seconds upon a special dial. The several hands upon this dial show the time (mean solar time) for Gotha, the mean time for Europe, as well as that for Greenwich. Moreover, upon two small dials within the ring of the main dial are shown the hours and minutes of the true solar time, as well as the hours, minutes, and seconds of the sidereal or star time, as well for Gotha as for Greenwich, which can be read from the inner ring of the seconds dial.

Upon the side displaying the church calendar appear such data as the ecliptic, the golden number, the Roman indiction, the dominical letters, the epacts, the Luna XIV or date of the spring full moon, as well as the dates of Easter festival and the first Sunday in Advent; besides these, the running time (winding and unwinding work), the alarm dial, and the dial for connecting or disconnecting the striking work. On this side also is found the winding staff. Upon the left side of the casing are shown the days of the week, with the dominical letters and epacts, as well as the dates of the Easter festivals for the future, whereas upon the right side appears the church calendar with the dates of the Ash Wednesdays. Behind the rear face of the cube appear the saints' days and such like as are customarily shown in calendars.

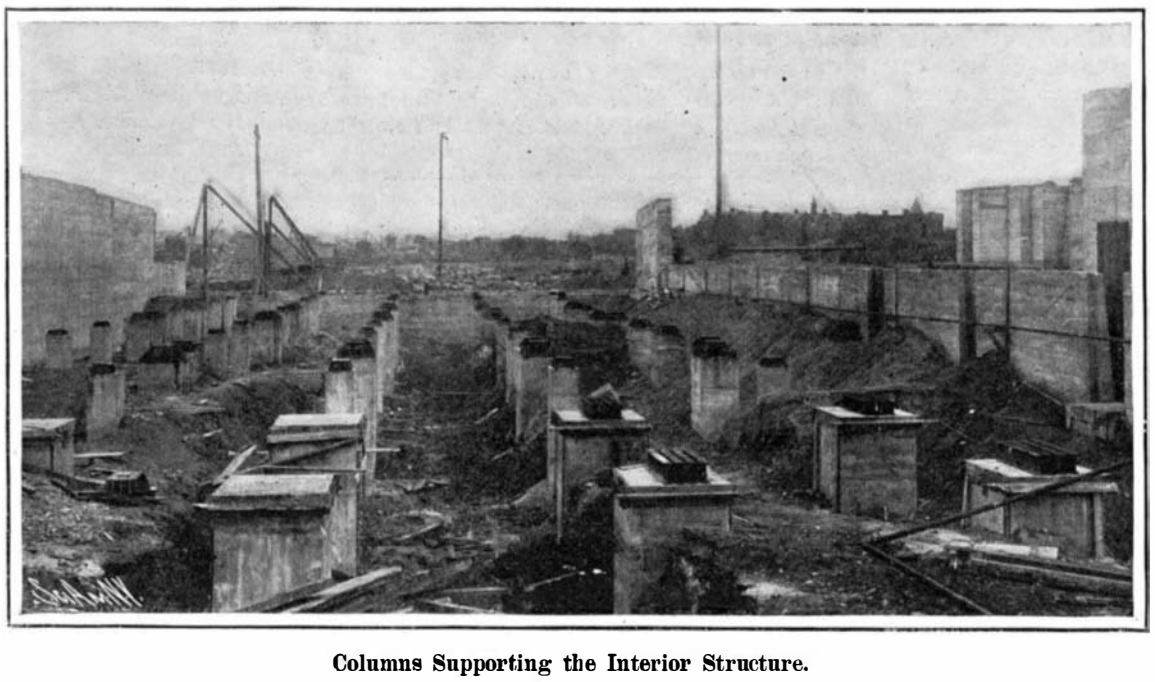
On the platform or upper surface of the cube rests a handsomely decorated foot 24 centimeters high, carrying upon its uppermost end a transparent glass sphere or globe, 17 centimeters in diameter, which turns within meridian and horizon rings of 30 centimeters outside diameter. Upon this glass sphere representing the firmament are visible some of the fixed stars and about it revolve not only the planets, but also the sun and moon in their correct periods. Perched upon the top of all is a small globe representing the earth, and on this is neatly balanced a magnetic needle, which points toward the south instead of the north, its barb having been made the south pole instead of the usual north. This needle is used in adjusting the clock exactly on the meridian of the place wherever it may be situated.

A so-called perpetual calendar is seen on the front of the base of the clock. This is not mechanical, but is manipulated by the hand, and will show instantly a complete year for any date, either in the past or the future.

An idea of the complexity of the work may be gained when we know that it contains more than three hundred wheels and pinions. The height over all is something over three feet, and to keep out the dust and preserve its untarnished appearance, the whole is covered with a glass shade, which for clearness in definition has been left out of the drawing.



Molding the Exterior Concrete Work. The Filling.



Columns Supporting the Interior Structure.

CONCRETE FOUNDATIONS OF THE NEW PASSENGER STATION, WASHINGTON, D. C.