Dear friend

I looked with care at all the figures you sent, and I believe can tell something, also if I haven't a fundamental datum, the declination of the wall.
LET START FROM SCHUERGRAF, ZAHN Is ZINNER FIGURES
The 1848 figure, and that of Zahn (1929) are substantially equal, the second the bad copy of the first. It is dealt with sketches made by people that presumably did know nothing about the Gnomonics; but they ignored other things also; or with faithful sketches, but the portrait of dials altered in past times in a way much "heavy."

For example:
In the inferior clock: there are the signs of the planets above the first curved line. In the order, from left Sun, Venus, Mercury, Jupiter(?- the sign seems a reversed C. It could also be the Moon.). To the right, a partial sign of Venus, then Mercury, still a reversed C, and then the sign of Saturn, moved toward the top, like an appendix of the Q letter of the word INAEQUALES.
To the epoch of construction of the clock (1487) the astrology applied to the unequal hours was very diffused, but it followed precise rules, that here seem to be applied at random, or not applied.
The guilt could not be of Schuergraf, and anybody (500 years are not few) could have modified the quadrant before him.

Also the fact that the hours 5 and 7 converge to the gnomon leads to suspect preceding tampering.

Here an ulterior detour needs to be done:
We are before the Reform of Luther, we therefore could do reference to Convents. The sundials of the Friars (said also "Mass dials") were very simple: a semicircle with the gnomon in the centre: the lines of the "hours" were the rays from the subdivision of the semicircle into 12 parts, any the latitude and the declination of the wall should be.

The converging lines 5-6-7 should make think to a "Friar" subdivision, but I think that the author has not done this kind of clock, because the overlap of the day length lines doesn't make sense, operation that makes think to a mathematical preparation rather elevated.
(Could the date be wrong?)

Only the correct construction of the clock in true unequal hours stays therefore.

The right subdivision of the solar day from dawn to sunset (in Latin *dies artificialis*) into unequal hours was a more complex problem, that involved the application of the only “instrument” then known, the Analemma.

The lines of the unequal hours are not straight lines, but curves (an S much stretched). The bending is more sensitive for the distant hours from the midday, and obviously for the latitudes a little bit tall (like that of Regensburg).
But the authors of the epoch (I remember Fineus, Apianus, and other) confined to find the extreme of the hour lines (for the vertical quadrants the points in the line of equinox and those in the Capricorn line - the points of the Cancer line were few, limited to 4 or 5 central lines). The hour lines were straight lines, also they didn't divide the day exactly. But an error of any minute was tolerable.
(Still in the 17th century it was discussed, if the lines of the unequal hours should be curves or of straight lines)

The hour lines are “at random”. Certainly they don't correspond to what was (whatever it was) the aboriginal 1487 sketch on the wall.

Also the superior quadrant has been designed in a casual way. In 1509 in Germany notable mathematical fellows lived, and famous diallist. I could not think that the gnomon is the iron designed in those sketches.
Therefore I would go rid of the sketches of Schuergraf, Zahn and Zinner like not corresponding to the reality, or as the faithful reproduction of preceding "restaurations" made from anyone absolutely strange to the dialling.

ACTUAL STATE

The superior clock

Looking at the photo I deduce (here am not sure, because the photo, as we will see, tells two different ideas) what follows:

An equal hours clock is dealt with, in Latin *Horae verae*. The gnomon is in the correct place, tilted toward the lower part. Its angle with the vertical wall (but is it very vertical?) must be of 41°, because the latitude of Regensburg is 49°.

(It perhaps is not important, but I want add that Stoffler, in his book on the astrolabe, quotes 48° the latitude of Ratisbona; he says that the latitudes are the ones in the Geographia of Ptolemy. It could be that our clocks have stayed originally calculated for 48°, and not for 49)

Comparing the position of the black near points to the numbers of the hours with the lines of the joints of the stones, I deduced that the clock has been built for a wall slightly declining toward West. I took away again (in an approximate way, obviously) the angles, deducing that the wall declines around 2°30'.
I have tried, always over the photo, to unite the hour points according to a rule that can be found in a 1586 book of Clavius, getting in practice, with the usual inaccuracies that are had working on a photo, the confirmation that the actual clock has stayed built for the latitude of 49°. The graphic schemes I did confirm the little declination of the wall toward WEST.

Inferior clock
Obviously the same declination has also been applied to the inferior clock, with very debatable results:
A fact is fairly strange: the line of the 12 hours length of the day is fully grown from two segments slightly tilted in opposite directions (that is also confirmed by the Fig 1 of the IPG file you have sent): it would be told that whoever has designed the quadrant has designed the right part (of the man look at) with the West declination of above, and the left part symmetrically. What is laughable….

The 12 hours line is the equinoctial line, and it therefore must be a straight line. If my hypothesis on the declination is exact the position of the gnomon is right.

I have verified, always with the Analemma, (I used exclusively the methods in use around the year 1500) the subdivision of the length of the day along the line of the midday (*hora sexta*) and I have found that it is substantially exact.

CONCLUSION

Once the modest declination of the wall is sight (presumed, not verifiable with certitude through the photo), the two sundials can be considered acceptable. At morning the error of the inferior sundial is of any minute (it marks hours shorter than the right).
The extreme hours (1,2,3 and 9,10,11) are not "correct", from the point of view of a builder of 1487, but probably the renovator made them with the calculus (*only to right? It is difficult to accept*) noting of their bending.

The figures of the planets above the lines of the days are ornamental sketches, and they don't offer reasonable indications for their possible astrological use.

The End

NOTE: the sequence accepted from the astrologers was, starting from the nearer planet
Moon Mercury Venus Sun Mars Jupiter Saturn
The first hour of the day gave the name to the day (Sunday, Monday, etc.) The names of the days today are not the ones of the ancient astrologers; anyone has changed its name. In England for example the names are partly those of the Gods the Saxon cycle. In Italy only "Sabato e Domenica" do not remember the planets (Saturday and Sunday – in English the names are those of the planets).
In Germany ?

The following hours of every day of the Week are dominated by the other planets in sequence. The Saturn hours were negative. (*That is all I know on the matter: Saturn dominated Saturday from the first hour; therefore the day was all-negative, for which the fellow should do nothing. So the wealthy Roman invented the day of rest.)*

UNEQUAL HOURS	1 D	2 A	3 Y	4	5	6	7	8	9	10	11	12	1 N	2 I	3 G	4 H	5 T	6	7	8	9	10	11	12
Sun day	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r
Moon day	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v
Mars day	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s
Mercury D.	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w
Yupiter D.	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q
Venus Day	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t
Saturn Day	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u	q	s	r	t	w	v	u

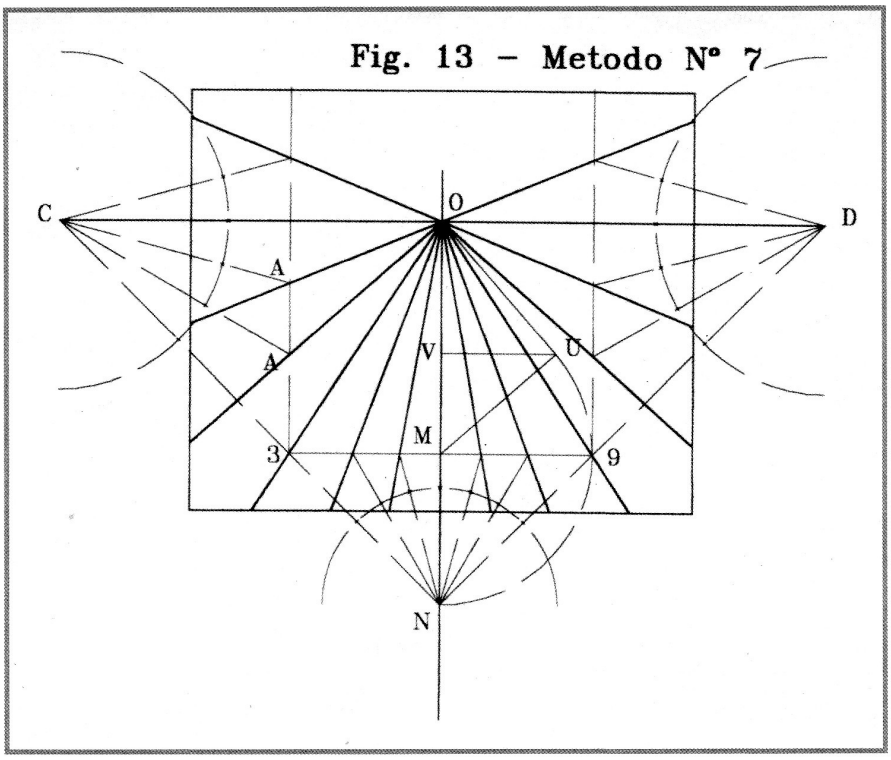
Let me come back on Regensburg (Ratisbona)

As I have already told the last time, a certain probability exists that the two sundials are fruit of repeated restorations.

The affirmations of whoever affirms that the superior clock is fruit of the work of a beginner are fairly unfounded. The French sundials of the 19th century are all with only the hour lines, but this is a choice that doesn't exclude that the author is not able of do a more complex dial.

To regulate a mechanical clock, e.g., one hour line is enough, that of any hour (almost always that of noon); but from there we can't arrive to the conclusion that the diallist doesn't know his job….

If we apply for example the method illustrated by Schöner (see Gnomonica Italiana N° 3 Pag. 25 - fig. 13),



a method probably known by preceding mathematicians, like Apianus and Stabius. The dial made in that way corresponds almost exactly. (I should prefer the method of Clavius, but it is of 1586…)

The clock could not be derived from a preceding clock with the perpendicular gnomon, as a "Mass Dial" in use in convents. These were approximate clocks, a semicircle divided into 12 equal parts. They didn't mark the hours, but the times of the prayers in relationship to the the Sun. The existing clock has the hour subdivision very different: it is a true sundial.

The matter of the mix between Arabic figures and Roman numbers remains. It seems to me it is not the case of discuss about today.

The building of the Temple has stayed broadly modified, and fully reconstructed; who knows how much "restorations" the two clocks have suffered.
We can accept the considerations of David King like an example of the new introduction in the Northern European area of the Roman Ciphers (in "Gothic" model or not), as a consequence of the revaluation of the Latin texts and of the ancient Roman civilisation. It seems the example is ill-chosen, because we don't know if the actual state is that of the 16th century, or it is a reproduction "invented" in a more recent period.

It is true that from the 12th century the Roman ciphers were not in use in the texts of Astronomy (I have a text of Campanus de Novara, one of Profacius, that on the Astrolabe of Chaucer, all with Arabic numeration…) but it is also true that the Florentine bankers used always the Roman numeration, up to the half of the 16th century. They

believed that with the Arabic ciphers the documents of payment were easiest to be modified. Besides in the roman Church the Roman numbers have never stayed abandoned (and the sundials of Regensburg date (theoretically?) to a preceding epoch of the Reform).

If the dates are not true, and the sundials are of a following epoch, in Protestant background, very probably King is right; Melanthon had a notable influence both in religious and in humanistic environment.

No more I can tell. The doubts stay. But I repeat that I exclude that the sundial is a modification of a preceding Mass clock and that the gnomon was initially perpendicular.