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**The Back Cover
Inscription**

Almagest

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Abstract

This paper presents an edition with translation and commentary of an extended text that was inscribed on a plate (or conceivably a pair of plates) that lay against the rear face of the Antikythera Mechanism while it was under the sea. This plate, which may have functioned as a protective cover, is extant only in small fragments, but more of its text was preserved as offsets on a layer of accreted matter that built up against it. The text was a systematic description of the dials, pointers, and other external features of the Mechanism, beginning with the front face and continuing with the rear face. The best preserved passages include descriptions of features on lost parts of the Mechanism: a display of pointers bearing small spheres representing the Sun and planets on the front dial, and a dial on the upper back face representing a 76-year "Kallippic" calendrical cycle.

5.1 Introduction

During a long interval of the Mechanism's immersion in the sea, an inscribed bronze plate (or conceivably a pair of plates) about two millimeters thick lay against the Mechanism's rear, with the inscribed side facing inwards and oriented right way up with respect to the Mechanism. The plate was not flush with the Mechanism's back plate, in part at least because the pointers of the back dials held them apart. Through the action of the seawater, a film of hard accretion of variable thickness, but generally less than a millimeter in depth, built up against the inscribed face, so that its surface was a negative copy of the plate's surface, with the inscription's engraved lettering reproduced as slightly raised, mirror-reversed offsets.¹ Eventually the inscribed plate fragmented, and by the time that the Mechanism's fragments were salvaged, most of the plate had fallen off, leaving much of the accretion layer still attached to the fragments together with some patches of the plate itself. Remains of the offsets and original plate are found in the present Fragments A, B, and E, as well as Fragments 19 and 67, which are pieces of the plate separated from A in 1905.

The physical relation of the plate to the Mechanism when it was intact is uncertain. Price supposed that, in addition to bearing the inscription, it served as a hinged "door" protecting the back face when the Mechanism was not in use.² Assuming that its remains were found in roughly their original locations, the text would have been visible to a spectator only when the door was open. Since, however, no evidence of hinges has been identified, we follow more recent investigators in speaking of the plate as the "Back Cover," and so its inscription is formally called the "Back Cover Inscription". The truth is that we do not know whether the plate was intended as a protective cover rather than a detached sheet meant to be deployed in some other way, which either was intentionally stored against the back face for safer transport or accidentally got that position during or after the shipwreck.³

In all, parts of fifty-five lines of text are preserved. It can be inferred that the text was written in a single wide column (averaging around 75 letters to a line), running along practically the full breadth of a plate having about the same width as the Mechanism's faces, since a

1 The initial explanation of the mirror-reversed lettering seen on Fragment B when it was discovered in 1902 was that one was seeing the back of an engraved plate; see for example Rediadiis in Svoronos 1903a, 46 = Svoronos 1903b, 45. Theofanidis [1927-1930], "98" (correct pagination 90) seems to have been the first to give the correct explanation in print.

2 Price 1955, 65, and Fig. on 62-63; Price 1974, 21-22 (where a "diptych" arrangement with two hinged doors is suggested). The "door" nomenclature was retained in Freeth et al. 2006, 587, and Freeth, Jones, Steele, & Bitsakis 2008, supplementary notes 7.

3 See section 3 for discussion of a plate fragment with a sliding catch in Fragment F, which, if it came from what we are calling the Back Cover, would confirm that it was indeed a removable cover.

layout in two or more columns would not accommodate the minimum of words required to obtain continuity of sense between some of the consecutive preserved parts of lines. The surviving text comes from towards the beginnings (left ends) of the lines, with many line beginnings either preserved or reconstructible.⁴

The offset layer on Fragment B-1 (Fig. S2) shows very clearly both the left margin of the text and the physical left edge of the Back Cover, which was very close to the margin and very nearly parallel to the sides of the Back Plate. If we extrapolate this edge downwards, using the known original configuration of Fragments B and A, we find that the line would have fallen about a centimeter to the right of the left margin of the text preserved in A-2 (and E), which also inclines slightly clockwise relative to the edge of the Back Plate (Fig. 5.1). In other words, looking at A-2, we see the lines of offset text as not exactly horizontal but inclining slightly upwards to the right.⁵ The margin of the plate on B-1 and that of the plate on A-2 and E were respectively about 30 mm and 20 mm to the right of the back plate's edge (i.e. to this edge's left when we are looking at the mirror-reversed offsets on the fragments). Hence at the time that the offsets were formed, the Back Cover was split in two parts, either through a fracture or because it originally comprised two separate plates, and both parts were in somewhat different laterally shifted positions relative to the Mechanism's frame.

4 In this discussion we use "left" and "right" in relation to the text as it appeared on the inscribed plate. The directions are reversed on the preserved offsets.

5 Aside from considerations of physical appearance, the margins can be identified by their consistently lining up with beginnings of words or syllables according to the standard Greek conventions for line breaks.



Figure 5.1: Mirror-reversed image of B-1 superimposed on A-2 in its approximate original position, with the left margins of the Back Cover Inscription shown as white lines (Image: National Archaeological Museum, Athens, photographer: Kostas Xenikakis, copyright: Hellenic Ministry of Culture and Sports/Archaeological Receipts Fund)

The total preserved height is about 200 mm, and it is not clear how much text preceded or followed the extant lines. A plate coextensive with the Mechanism's faces could potentially have held about ninety lines of text, or on the order of twelve hundred words. This would be the equivalent of four or five pages in a typical modern edition of an ancient Greek prose text. At a minimum, the text was about two-thirds of that length.

The recognition of the Back Cover Inscription as a distinct entity was due to Price, following upon his discovery of how Fragments A and B fitted together. The part of the inscription preserved in offsets on B had been remarked, and a few letters successfully read, at the time that the Mechanism was first noticed in the Museum in May, 1902, but to the early investigators it was not clear, for example, that the mirrored text on B-1 and the normally oriented text visible on A-2 —actually part of the Back Plate Inscription— did not come from a single inscription. The natural presumption was that a text accompanying a mechanical instrument ought to contain an explanation of how to operate the instrument; and as bit by bit more of the inscription was read, with terminology showing up relating to both astronomical objects and mechanical elements, the label "instruction manual" persisted. We can now see, however, that this characterization is not quite exact though it comes close to the truth. The text, so far as it survives, does not contain instructions for operating the Mechanism (except perhaps in part II.5-16), but it systematically *describes* the visible components of the Mechanism. Its relation to the Mechanism was like that of a caption to a drawing or picture, addressed to the viewer rather than to the operator, and explaining the meaning of what he or she was seeing.

The part of the inscription surviving on Fragment B appears to have concerned the Mechanism's front face, and its better preserved lines appear to be inventorying features in a more or less radial order from the center of the front dial outwards. The part in A, E, 19, and 67 relates to the rear face, describing in turn the upper spiral dial, the subsidiary dials enclosed within the spiral, the lower spiral dial, and the subsidiary dial enclosed in it. Since the division between the accounts of the two faces apparently coincided with the discontinuity in the lateral shift of the text's left margin, the possibility arises that the inscription comprised two detached plates that were meant to be deployed or mounted so that one could read the plate concerning each face while looking at that face. For example, the intention might have been that the Mechanism would be mounted on a plinth at a suitable height for convenient operating and viewing, with the explanatory plaques fixed to the front and back of the plinth.

The principle of furnishing a publicly displayed scientific object with an explanatory "caption" inscription can be paralleled in several Greek inscriptions that accompanied sundials, for example the following inscription (since lost) copied by Cyriacus of Ancona in 1444 in Samo-

thraki from one face of a marble pedestal in the form of a triangular pyramidal frustrum.⁶
 «τοῦ γνώμονος ἡ | [σκι]ὰ ἐπιούσα ἐπὶ τὰς γραμμὰς ση|μαίνει τὰς ὥρας | τοῦ ἐνιαυτοῦ καὶ | τῆς
 ἡμέρας. | Τροπῶν θερινῶν | πρώτη, ἰσημεριῶν ἢ μέση, | [χει]μερι[ν]ῶν ἢ ἐσχάτη».
 (“When the shadow of the gnomon reaches the lines, it indicates the seasons of the year
 and the hours of the day. The first (line) is for the summer solstice, the middle one is for
 the equinoxes, the last one is for the winter (solstice)”).

The sundial captions are obviously much briefer than the Back Cover Inscription, because the objects that they explained were, from the viewer’s perspective, much simpler. More comparable in scale to the Back Cover Inscription are the captions (ὑπογραφαί) that Ptolemy provides in *Geography* 7.5, 7.7, and 8.3-28 to accompany his maps of the known world and its regions.⁷ For example, the caption for the world map (7.5), which runs to nearly a thousand words, inventories the three continents, the seas and unknown lands that border them, and the largest bays and islands, as well as specifying the known world’s limiting parallels and meridians and its north-south and east-west dimensions.

While part of the interest of the Back Cover Inscription for us is the light it casts on how the Mechanism’s makers imagined that people would experience it and what they would need to know in order to appreciate it, the text also contributes to our knowledge of the Mechanism’s appearance and functions. At early stages in the study of the fragments, when little had yet been deduced from the physical evidence, readings from the inscription, though limited to disconnected words and phrases, were instrumental in establishing that the Mechanism was an astronomical device. The serendipitous occurrence of numerals representing 19 years, 76 years, and 223 (lunar months) on Fragment 19 pointed researchers to the crucial role of the Metonic period and the Saros cycle in determining all the functions relating to the Sun and Moon. In the present, more advanced state of reconstruction of the Mechanism, the part describing the back face serves mostly to reinforce the understanding of the back dials and their pointers that we can obtain in the first instance from the substantial parts that survive of them and of the gears that drove them — though it is only from the inscription that we learn that there were two subsidiary dials inside the upper spiral dial but just one inside the lower spiral. The part describing the front face, on

6 Gibbs 1976, 394, no. 8008, following the restoration of the text in Wilhelm 1937 (we reject the emendation of ἰσημεριῶν to ἰσημερινῶν in the 8th line); for Cyriacus’s drawing, see Bodnar & Mitchell 1976, 79 and 88. Other examples, incompletely preserved, include inscriptions from Amastris (Gibbs 1976, 392, no. 8001), Oropos (Schaldach 2004, 442, inscribed on the sundial itself), and Alexandria (Breccia, Alexandria Mus. No. 185, for which see Jones 2014, 178-181). The Alexandrian inscription runs to more than a hundred words, and was probably much longer when complete.

7 Berggren & Jones 2000, 4, 108-111, 117, and 121-122.

the other hand, gives its clearest testimony precisely where the physical evidence is most defective, namely with respect to the way that the Mechanism displayed the motions of the planets.

chiefly along the right edge (i.e. the beginnings of the text lines). It appears that B-1 was left more or less untouched in the 1905 conservation, but was subsequently cleaned of superficial material concealing the offsets, probably during the 1953 conservation.

The greater portion of Part II survived in a similar manner, as an accretion layer lying over the Back Plate on Fragment A-2, with smaller pieces of the Back Cover plate still adhering to the accretion layer. The earliest photograph (supplementary Fig. S6), published in 1903, shows A-2 in this state. The photograph is not as clear as one would wish, but seems to show the accretion layer as having a more or less rectilinear right edge about 20 mm to the left of the right extremity of the fragment, with the rest of its outline irregular; the layer's dimensions were apparently about 50 x 85 mm. No letters can be made out, and it is not possible to discern which regions of the accretion layer were covered by fragments of the Back Cover plate.

The 1905 photograph of A-2 shows the state following the 1905 conservation work, part of which consisted of separating the surviving bits of the Back Cover plate, i.e. the present Fragments 19 and 67.⁸ The accretion layer appears almost as extensive as in the 1903 photograph, but about a centimeter (or less) seems to have disappeared off the lower edge. The surface apparently had not been cleaned, and no lettering can be seen, though this is in part due to the relatively poor quality of the photograph. Rehm wrote *Patinaabklatsch* ("patina-offsets") along the lower edge on his print of the photograph, which shows that he had seen mirrored letters there, and understood how they had formed. In the 1918 photograph (supplementary Fig. S7), the accretion layer appears unaltered from the 1905 state except that a small region at the lower left had now broken off, but the much sharper image shows some lettering.

By the 1950s, the accretion layer had suffered more damage; more or less the lower half of the area visible in the 1918 photograph was no longer on A-2. Most of this material seems to have been entirely lost, but a piece about 25 x 20 mm survived as a detached fragment, visible in some of Price's 1958 photographs. It has since been rejoined to A, though not exactly in its original location (which can be determined from the 1918 photograph) because a bit of the Back Plate that provides the linkage is gone. The surface of what remained of the accretion layer (Figs 5.3 and supplementary S1) was cleaned, probably in the 1953 conservation work, so that much more of the mirrored text became legible. There are, however, significant regions whose surface is abraded to the point that the letters are illegible or entirely obliterated.

8 Fragment 67, slightly larger than it is now, appears in one of 1905 Karo photographs alongside Fragments 19 and D.

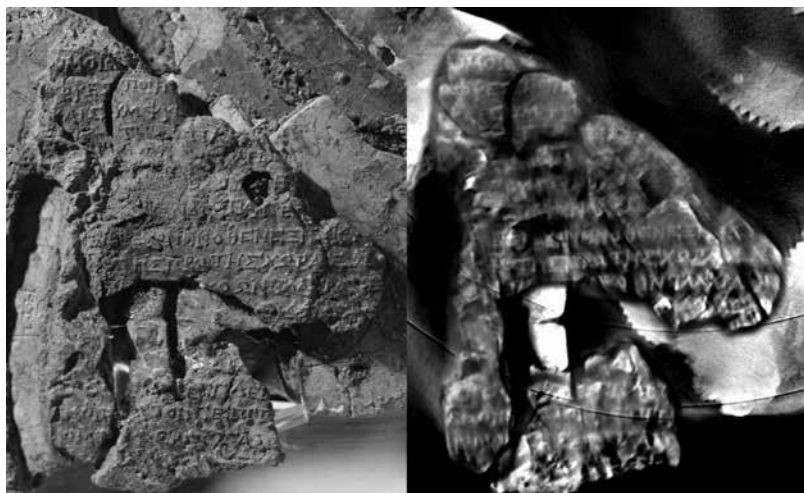


Figure 5.3: *The Back Cover Inscription preserved on A-2: (left) mirror-reversed photograph, (right) CT composite image*
(Images: photo Niels Bos; CT Antikythera Mechanism Research Project)

Fragment 19 (Fig. 5.4, left) is an oval piece of the Back Cover plate, about 50 x 40 mm. Most of its surface is in excellent condition; the preserved text partly coincides with surviving offsets on A-2, but some of the corresponding offsets were lost in the pre-1950s damage. Fragment 67 (Fig. 5.4, right), another piece of the Back Cover, is about 10 x 10 mm, and matches an extant region of the offsets.



Figure 5.4: *Fragments 19 (left) and 67 (right)*
(Images: National Archaeological Museum, Athens, photographer: Kostas Xenikakis, copyright: Hellenic Ministry of Culture and Sports/Archaeological Receipts Fund)

Fragment E has an irregular region, about 40 x 60 mm, of the offset layer, some of which is covered by pieces of the Back Cover plate (Fig. 5.5)

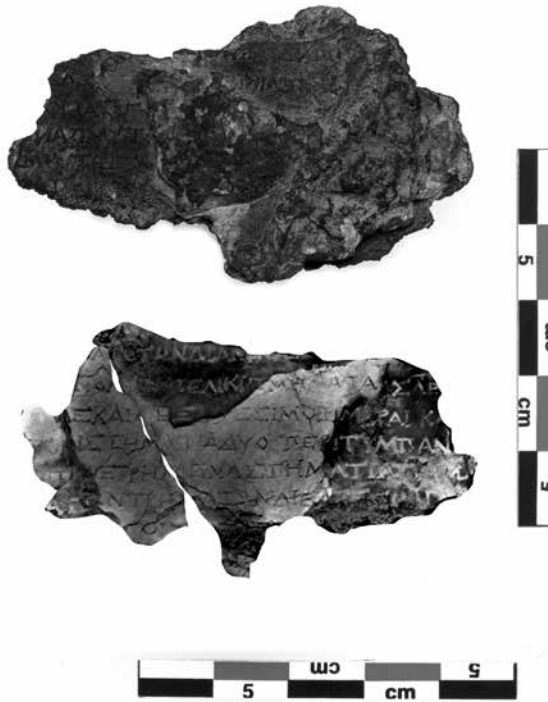


Figure 5.5: *The Back Cover Inscription in Fragment E: (top) mirror-reversed photograph, (bottom) CT composite image*
 (Images: National Archaeological Museum, Athens, photographer: Kostas Xenikakis, copyright: Hellenic Ministry of Culture and Sports/Archaeological Receipts Fund; Antikythera Mechanism Research Project)

Fig. 5.6 shows the parts of the Back Cover Inscription preserved on Fragments E, 19, and 67, overlaid on the surviving offsets of A-2 and the 1918 photograph (both mirror-reversed).



Figure 5.6: *Composite image superimposing photographs of Fragments 19 and 67 and CT composite of E on photograph of the surviving inscription on A-2 on the 1918 photograph of A-2 (Images: Antikythera Mechanism Research Project; Niels Bos; Bayerische Staatsbibliothek, Rehmania III 9)*

Fragment F contains a small piece from the corner of a rectangular plate with a sliding catch similar to the catch on the Front Plate preserved in Fragment C. It has been suggested that this was a piece of the Back Cover plate, but it bears no inscription and may well have

belonged to a different component of the Mechanism, possibly even the Front Plate itself.⁹

On Fragment B the line spacing of the text averages approximately 3.5 mm baseline to baseline (measured on CT from I.3 to I.26), and the typical letter height is about 2.0 mm though with considerable variation. In the preserved parts of I.16-25 the average letter width including space between letters is approximately 2.2 mm, but the average for individual lines ranges from about 1.9 mm to about 2.6 mm. Assuming a usable plate width of about 165 mm, complete lines would have averaged about 75 ± 10 letters per line. Fragment 19 averages a slightly larger line spacing of 3.7mm baseline to baseline (measured from photograph from II.14-23); the letter heights and average widths (measured in II.16-18) are consistent with those from B. The remains on the other fragments are insufficient for precise measurements of the lettering, but consistent with those from B.

9 See IAM 3.2.

5.3 Previous transcriptions and study of the Back Cover Inscription

Wilhelm's and Svoronos's readings of a few words from the offsets on B were announced in the Athens newspapers soon after the discovery of the fragments in May 1902 and consensus settled on two points: that the text consisted of instructions for the instrument's use, and that the presence of references to the Sun and (probably) Venus established the instrument as astronomical. The first formal transcription, however, was in Rediadis's 1903 report on the Mechanism; it is credited to Svoronos with contributions from Wilhelm.¹⁰ In terms of the number of letters read, it was an advance on the version given in the newspapers the previous year, but scarcely in terms of understanding of the text since hardly any new recognizable and meaningful words had emerged. A transcription of similar extent, though diverging in the reading of some of the letters, was published by Theofanidis; it was probably the work of Leonidas, whom Theofanidis elsewhere credits with assisting him with the inscriptions.¹¹

Valerios Stais gave the first transcription of the recently separated Fragment 19 in his 1905 monograph on the Antikythera wreck.¹² Again probably relying on Leonidas, Theofanidis subsequently published a more accurate text.¹³ Theofanidis also mentioned the presence of offsets on Fragment A, apparently being the first scholar to do so in print, but did not attempt to transcribe them.¹⁴

The Stamires-Price transcription in *Gears from the Greeks* represents a major advance, made possible by the 1953 conservation which had greatly enhanced the legibility of the offsets on A-2 and B-1, and Price's determination that those on B-1 had originally been more or less directly above those on A-2.¹⁵ The transcription of Part II is a composite of readings from A and 19, together with a few unattributed readings that likely came from a manuscript transcription (which cannot now be located) of A, presumably by Rehm, made when the offsets were better preserved.¹⁶ Price had little to say in general about the contents of the

10 Svoronos 1903a, 46 = Svoronos 1903b, 45-46. The transcription is reproduced by Rados 1910, 10.

11 Theofanidis [1927-1930], "98" (correct pagination 90), and 1934a, 143. The acknowledgement of Leonidas's assistance is at Theofanidis [1927-1930], "99" (correct pagination 91), note 1.

12 Stais 1905, 22, note 1; reproduced in Rados 1910, 11.

13 Theofanidis [1927-1930], "99" (correct pagination 91), and 1934a, 144.

14 Theofanidis [1927-1930], "98" (correct pagination 90): "σωρεία πεπεσμένων γραμμάτων ἀπολύτως ἀνεπιδέκτων ἀναγνώσεως."

15 Price 1974, 47.

16 The presumed "Rehm" readings appear in the beginnings of the last several lines, with

Back Cover Inscription, but he remarks about the lines in Part II that were best preserved (largely through Fragment 19) that “on the whole it seems that this text is concerned, as indeed it should be, with explaining the dials and pointer readings on the pair of back dials...,” a statement that we are glad to be in a position to confirm.¹⁷

A provisional transcription of the Back Cover Inscription was presented in the supplementary materials of the Antikythera Mechanism Research Project’s 2006 paper.¹⁸ While retaining many readings from the Stamiros-Price transcription, this text added letters read for the first time on Fragments B and A by means of CT, and incorporated the text from E which had not been previously transcribed.

Most recently, Freeth and Jones published in 2012 a discussion of the Back Cover Inscription together with a text of several lines from Part I revised by Jones¹⁹, though some readings have since been corrected.

the bottom two corresponding to an area of the offsets that is visible in the 1918 photograph but no longer exists. The handwritten drafts of the Stamiros-Price transcriptions in the Adler Planetarium collection show Part II in two states, before and after these readings were incorporated.

17 Price 1974, 50.

18 Freeth et al. 2006, supplementary information 8-9.

19 Freeth & Jones 2012, 2.3.1-2.3.2.

5.4 Transcription and translation

The Back Cover Inscription as we have it is divided into two series of consecutive lines, respectively preserved in Fragment B alone and in the group of fragments A, E, 19, and 67. Reconstructing the original relative positions of A, B, and E suggests that the last line in B, represented by only a few doubtful traces of tops of letters, ought to have been the line immediately preceding the first line in E, which is also represented by just a few letters. However, very small adjustment in the positioning of the fragments would create enough room for a lost intervening line or perhaps make the last line in B the same as the first in E.²⁰ The question of continuity is further complicated by the shift and twist noted above of the lower lines of the inscription relative to the upper lines. We therefore designate the two parts as I and II respectively, counting the lines in each part from 1. For the sake of concordance with earlier transcriptions, we note the following equivalences: our I.2 is AMRP (2006) line 1 and Price (1974) line 1; our II.2 is AMRP line 28; and our II.8 is AMRP line 34 and Price line 30.

Part I was read primarily from CT of Fragment B supplemented by PTMs ak35a, ak36a, and ak37a. Part II was read from CT (E and 19); PTMs ak1a (19), ak47a (A), ak49a (A), and ak61a (67); digital photographs kindly provided by Niels Bos (A), and the 1918 (?) photograph of A2. Letters visible in the 1918 photograph but no longer preserved are underlined>.

Part I, text.

- 1 ..[
- 2 ταύτην δ[
- 3 δεῖ δ' ὑπολαβ[εῖν
- 4 ὑπὸ δὲ τὸν τω .[
- 5 δ[-6-]οικα[
- 6 ε[-9-]ηιση[
- 7 [-10-]ηροσ[
- 8 ρ[-10-]μθε[
- 9 .[-10-]ν ἡρμοσ[
- 10 [-11-] ἐπ' ἄκρου δ[
- 11 [-11-] .ωσμένων .[
- 12 [-12-]ξ μέλαν στ .[
- 13 [-11-] λων γεν[
- 14 [-10-] .ε . δ' ὑπολαβεῖ[ν
- 15 [. .]οθε . . τὸ σφαιρίον φερε .[
- 16 προέχον αὐτοῦ γνωμόνιον σ[

20 In the transcription in Freeth et al. 2006, supplementary information 8-9, I.29 is equated with II.2. We believe this is definitely too tight a relative placement of the two parts.

- 17 φερειῶν ἢ μὲν ἐχομένη τῶι τῆς [
 18 τος, τὸ δὲ δι' αὐτοῦ φερόμενον [
 19 τῆς Ἀφροδίτη<ς> Φωσφόρου ... [
 20 τοῦ [Φω]σφόρου περιφέρειαν . [
 21 γνώμῳ [.] κείται χρυσοῦν σφαιρίον . . [
 22 Ἡλί[ου] ἀκτίν', ὑπὲρ δὲ τὸν Ἥλιόν ἐστιν κυ [
 23 [-3- το]ῦ Ἄρεως Πυρόεντος, τὸ δὲ διαπορε[υόμενον
 24 [Διὸς Φα]έθοντος, τὸ δὲ διαπορευόμενον [
 25 [νου Φα]ίνοντος κύκλος, τὸ δὲ σφαιρίον φλ [
 26 [-7-]ερα δὲ τοῦ κόσμου κείται ... [
 27 [-10-]μεν[.] στοιχεῖα παρακείμενα [
 28 [-12-] , αὐτα ταῖς ἀσπίδ[ίσκαις
 29 [-12-] ἠροειρημένῳ [
 30 [-16-]αση[. .] . [

Part I, apparatus

- 1 . : along edge, bottom of serified vertical somewhat to right of margin, with trace of descending diagonal meeting the vertical just above the serif from the left side (perhaps v); to the right of this, two small traces at baseline level, not serified.
 3 β: small trace of lower left corner of letter
 4 δ: horizontal stroke at baseline level | . : serified bottom of vertical stroke extending slightly below baseline
 5 . : small trace at top level along edge
 6 π: vertical with serif at bottom, part of horizontal projecting slightly left of vertical
 7 π: right part of horizontal at top level, top part of left vertical, short serified right vertical |
 σ: left half of letter with corners at top and bottom
 8 ο: left side of loop | μ: right half of vee and right vertical serified at bottom | . : small traces at edge at top and baseline level, e.g. σ or x
 9 . : small trace at top level along edge
 10 ε: indistinct traces of right ends of top and bottom horizontals
 11 .¹: indistinct traces at edge, conceivably right part of vee and right vertical of μ | .³: trace at baseline level, possibly lower left corner of σ
 12 ε: top and bottom horizontals and part of vertical visible in PTM ak35a | . : indistinct traces, possibly a vertical serified at bottom
 13 first letters extremely indistinct, conceivably ... κυκλῶν
 14 .¹: indistinct | ε: bottom half of letter with middle horizontal, faint | .²: indistinct
 15 θ: bottom half of letter, rather angular and with the right ascending stroke projecting slightly below baseline (a deformed u cannot be ruled out) | . : indeterminate traces along edge, and traces of serified right ends of horizontals at top and baseline level along edge | . : trace at top level, e.g. τ or σ
 19 ... : extremely indistinct; conceivably . σ .
 20 . : trace along edge of vertical or loop

- 21 $\dot{\nu}$: serified bottom of vertical, somewhat to right of ν , followed by lower left portion of loop(?)
 22 $\dot{\iota}$: serified top of vertical
 24 $\dot{\nu}$: left vertical stroke
 25 $\dot{\tau}$: right half of letter | $\dot{\lambda}$: apical letter, no horizontal visible
 26 ϵ : traces of serified right ends of horizontals (?) at top and baseline level along edge | δ : lower right corner of letter | \dots : very indistinct traces
 28 $\dot{\nu}$: trace at edge at top level | δ : top of apex
 29 η : top right corner of letter | ρ : loop | σ : top of apex
 30 σ : top of apex | σ : top horizontal and left extremity of descending diagonal | η : horizontal stroke at top level with slight traces of two verticals | $\dot{\nu}$: horizontal stroke at top level?

Part I, translation

- 1 ...
 2 this ...
 3 One should understand...
 4 Below the...
 5 ...
 6 ...
 7 ...
 8 ...
 9 ... fitted(?)...
 10 ... at the tip...
 11 ...
 12 ... black...
 13 ...
 14 ... one should understand...
 15 ... the little sphere travels...
 16 ... little pointer projecting from it...
 17 arcs, the one next to the... of the...
 18 Stilbon(?), and the... travelling through it
 19 of Aphrodite Phosphoros...
 20 the arc of Phosphoros...
 21 on the pointer lies a golden little sphere...
 22 ray of the Sun, above the Sun is the circle(?)...
 23 of Ares Pyroeis, and the... making its way through...
 24 of [Zeus] Phaethon, and the... making its way through...
 25 circle of [Kronos] Phainon, and the little sphere...
 26 ... of the cosmos lies...
 27 ... letters situated beside...
 28 ... the little disks...

- 29 ... aforesaid...
30 ... disk(s)(?) ...

Part II, text

- 1 [-4-] .λοσ[
2 [-4-] ἀπό τῶν διαιρέσε[ων
3 [.. ἐ]ν ὄλη<|> τῆι ἔλικι τμήματα ν σ̄λε [
4 ΤΑΙ ΔΕ ΚΑΙ ΑΙ ΕΞΑΙΡΕΣΙΜΟΙ ΗΜΕΡΑΙ ΚΑ[
5 [Ἔ]χον στημάτια δύο ν περι τυμπάνι[ον
6 [τ]ῆ προειρημένα στημάτια τρημα[
7 [δι]ὰ τῶν τρήματων διέλκεσθαι ..[
8 ὁμοίως τοῖς πρῶ .[] ... [
9 φυές ποιησ[..] τυμπ[
10 καὶ συμφυέ[ς
11 [.]α στημάτια [
12 [-7-]σ[..]αγξσ[
13 [-2-]ρροϋ ..θροῦ[.]η[
14 [-4-] τὴν ἐναντίαν ν ε [
15 [...] περόνην ὄθεν ἐξηλικύσ[θη
16 [...] τῆς πρώτης χώρας ν μι[
17 [γνώ]μόνια δύο ν ὦν τὰ ἄκρα φέ[ρεται
18 [..] τέσσαρα, δηλοῖ δ' ὁ μὲν τή[ν
19 .ς τὴν τῆς ν οςL ν ιθL ν του[
20 μος εἰς ἴσα ν σκγ ν συν τεσ[
21 τε .α . .ος διαιρέθη <|> ν ἡ ν ὄλη [
22 μον[....]οι ἐγλειπτικοὶ χρ[
23 ὁμο[ίω]ς τοῖς ἐπὶ τῆς ε [
24 ἀκροῦ φέρεται κ[.] .. [
25 ... μεντ .υη[

Part II, apparatus

Lines 1-7 are preserved in E.

- 1 .: apparently complete but gritty traces of ε or (less likely) σ | σ: bottom left corner
2 ε¹: bottom stroke with serif, and trace of bottom end of vertical | ε²: bottom stroke with serif, and trace of bottom end of vertical | .: trace at baseline
3 ν: one letter
4 α: left ends of ascending diagonal and horizontal, no serif visible
5 αδ: corr. from ον | ν: 1/2 letter | .: trace at baseline
6 .: trace at top level | α: trace at baseline
7 .: top of serifed apex and, to its right, trace at top level

Lines 8-9 are preserved in A and E

- 8 A ομοιω[
 E []ως τοις πρω []... []
 ς: serified right ends of top and bottom strokes | : horizontal at top level with serifs at both ends
- 9 A φυες ποιησ[
 possibly a trace of μ (tops of apices) to left of φ | ς: traces of top and bottom left corners along edge
 E [] μπ[]
 ..: horizontal at top level with serifs (?) at both ends, and to the right of this, serified top of descending diagonal

Lines 10-13 are preserved in A

- 11 q: faint | q: indistinct
 12 ς¹: faint | α: apical letter, faint | γ: complete, rather narrow | ε: indistinct, distorted | ς: bottom left corner
 13 ρϕ: complete but indistinct | ..: indistinct traces, the rightmost part of which resembles the right half of pi | θ: indistinct | δ: apical letter with apparent horizontal at baseline, but lambda cannot be ruled out

Lines 14-15 are preserved in A, 19, and 67

- 14 A [-5-] ναπτιαν ν ε[]
 :¹: possibly top half of ε | :²: trace of descending diagonal at top level, possibly χ
 67 [] την ε[]
 τ: vertical with bottom serif, right part of horizontal with serif
 19 [] τιαν ν ε[]
 :¹: bottom of vertical (?) along edge | ν: 1 letter | :²: ascending diagonal starting from baseline
- 15 A [-4-] ερονην οθεν εξηλκυσ[]
 ς: trace at baseline level along edge
 67 [] ερ[]
 : trace of horizontal or serif at top height
 19 [] ν οθεν εξηλ[]
 :¹: vertical with serif at bottom | :²: small trace at baseline

Lines 16-23 are preserved in A and 19. Some letters legible in the 1918 photograph of A2 are now lost or illegible

- 16 A [...] της πρωτης χωρας ν μ[]
 τ: faint
 19 [] της πρωτης χωρας ν μ[]
 η: serified bottom of right vertical and small trace of horizontal | ν: half a letter
- 17 A [-3-] [-4-] υο ων τα ακρα φερ[]
 : sharp apex

- 19 []μονια δυο ν ων τα ακρα φε[
 ν: half a letter | ε: bottom of vertical with tiny traces of horizontals at baseline and mid level
- 18 A [-10-] . [..] ι δ ο μ .. []
 .: serified top of vertical | μ: top half of letter | ..: indistinct traces
- 19 [] α τεσσαρα δηλοι δ ο μ εν τη []
 α: descending diagonal of apexed letter
- 19 A . σ τ []
 .: apparently, right ends of a stroke ascending slightly at top height and descending slightly at baseline | τ: left end of serified horizontal at top level, vertical serified at bottom along edge
- 19 [] ν της ν ος L ν ι θ L ν του []
 .: serified top of vertical at top level | ν¹: one and a half letters | ν²: one letter | ν³: one letter
- 20 A μ ρ []
 μ: left ascending stroke with bottom serif clear, remainder of letter faint in depressed area of surface | .: traces at top level (?) and baseline along edge
- A₁₉₁₈ [] ος εις []
 19 [] εις ισα ν σκν ν συν τεσ []
 ει: faint | ν¹: one letter | ν²: half a letter | σ: top and bottom horizontals with serifs, small trace of meeting of diagonals, ε not excluded
- 21 A τ ε []
 A₁₉₁₈ . ε ος []
 19 [] α .. ος διαιρεθη ν η ν ολη []
 ν¹ and ν²: half a letter
- 22 A μ ρ ν [] ε γ λ ει []
 A₁₉₁₈ μ ρ ν []
 19 [] οι ε γ λ ει π τ ι κ οι χ ρ []
 ρ: faint
- 23 A ο μ ο [ι ω] ς τοις επι τ []
 19 [] ε πι της ει []
 ε: top horizontal and top part of vertical
- 24 A [-4-] . φ ε ρ ε τ αι κ []
 A₁₉₁₈ ακρον φ ε ρ ε τ αι []
 19 [] .. []
 ..: tops of two apices

Line 25 is preserved in A. Some letters legible in the 1918 photograph of A2 are now lost

- 25 A [...] μ εν τ ι υ η []
 μ: right vertical, slightly sloping, with bottom serif
 .: indistinct | υ: vee with serifs | η: horizontal and top parts of verticals
- A₁₉₁₈ ... μ ε ... []
 ...: indistinct | μ -: entire letter, indistinct

Part II, translation

- 1 ...
- 2 ... from the divisions...
- 3 ... in the entire spiral 235 sectors...
- 4 ... and the omitted days...
- 5 having two bearings around a disk...
- 6 the aforesaid bearings, perforations...
- 7 to be pulled through the perforations...
- 8 similarly to the first(?)...
- 9 cause to be attached... disk(?)...
- 10 and attached...
- 11 bearings...
- 12 ...
- 13 ...
- 14 ... the opposite...
- 15 ... pin from whence it was pulled out...
- 16 ... the first space...
- 17 two pointers whose tips travel...
- 18 ... four... one of them indicates the...
- 19 ... the 19-year period of the 76-year period...
- 20 ... into 223 equal (parts?) with four(?)...
- 21 ... the whole has been divided...
- 22 ... times(?) of eclipses...
- 23 similarly to the... on the...
- 24 tip travels...
- 25 ...

5.5 Commentary

Our commentary interprets the Back Cover Inscription as a systematic, feature-by-feature description of the Mechanism's exterior. The item-by-item concordance between Part II and the Mechanism's back face as we know it from the surviving pieces of the back plate and the reconstructed gearwork is compelling evidence for this interpretation. That Part I relates in a similar manner to the front face can be inferred from lines I.21-22, which obviously refer to a pointer display of the Sun's motion, since the existence of such a pointer on the front dial is implied by index letters on the zodiac dial, which correlate solar longitudes to stellar visibility phenomena in the Parapegma Inscription.

The sequence of lines I.19-25 within which the passage on the solar pointer occurs name, in order, the planet Venus, the Sun, and the planets Mars, Jupiter, and Saturn. One naturally expects mention of the remaining planet known in antiquity, Mercury. The planets are obviously listed in order of increasing presumed distance from the Earth in a geocentric cosmology. Several variant orders are known from Greco-Roman sources; they invariably place the Moon nearest to the Earth, and Mars, Jupiter, and Saturn in that order outward from the Sun, with the fixed stars furthest of all; where there was room for variation was in the relative order of Venus and Mercury and whether they were both nearer or further than the Sun.²¹ The sequence of the inscription would have to be either Moon-Mercury-Venus-Sun or Moon-Venus-Mercury-Sun. Since each planet evidently took up a full line or more of the inscription, there appears to be insufficient space for Mercury between the passages referring to Venus and the Sun (or following the passage concerning the Sun, for that matter). Hence we believe the order was the same as Ptolemy preferred, Moon-Mercury-Venus-Sun, and in fact the termination of the name for Mercury may be preserved at the beginning of I.18. (The planets appear in the same order — omitting the Sun — in the Front Cover Inscription.) The description of the display for the Moon, which fortunately we know a fair bit about from the physical remains, would have occupied the poorly preserved upper lines of part I.

It is a reasonable hypothesis that the inscription made the same kind of statement about each of the planets, though the verbal parallelism was not absolute. Taking into account the surviving stretches of text together with the known constraint that a line of text would have contained something in the neighborhood of 75 letters, we can reconstruct the form of statement as a version of the following:

²¹ The evidence for the various orderings is collected by Neugebauer 1975, 2.690-693; Ptolemy discusses some of the issues in *Almagest* 9.1 and in the part of *Planetary Hypotheses* Book 1 surviving only in Arabic (Goldstein 1967, 6-7). The astronomical Kesikintos inscription from Rhodes, IG XII,1 913 (Jones 2006a and 2006b), which has sometimes been cited in connection with the Mechanism, had the order Venus-Mercury-Mars-Jupiter-Saturn.

Above the circle of *planet X* is the circle of *planet Y*, and the little sphere that travels through it is *Z* [probably a color].

A series of such statements amounts to a description of a diagram of the geocentric system as a set of concentric circles or circular rings representing an onion-like cosmology of nested planetary spheres—actually spherical shells—within which the actual planets may be portrayed as small circles or spots. Such cosmological images are well known from Renaissance art,²² but they have an ancient pedigree that can be traced through numerous medieval manuscript illustrations even if no original example is known to have survived from antiquity. Fig. 5.7 is a translated redrawing of a simple diagram from a collection of scholia on Ptolemy's *Handy Tables* in the ninth century manuscript Florence *Laur. plut.* 28.01, f. 176v.²³ Fig. 5.8, redrawn and translated from the c. AD 1100 manuscript Florence *Laur. plut.* 9.28 f. 96r, is a similar diagram from the sixth century traveller Kosmas Indikopleustes's *Christian Topography* representing the "pagan cosmology" (as distinct from Kosmas's flat-Earth cosmology).²⁴ As these examples show, representations of the geocentric cosmology typically did not attempt to represent the distances of the heavenly bodies to scale, but just the relative order of distances of their "spheres" as a succession of bands of more or less equal breadth. The zodiac usually encloses the system, both as a synecdoche for the sphere of the fixed stars and as the apparent path travelled by the heavenly bodies. Kosmas' diagram also gives a concordance of the zodiacal signs with the Egyptian and Roman calendar months approximately coinciding with the Sun's traversal of each sign.²⁵

22 See Giusto de' Menabuoi's fresco "The Creation of the World" (c. 1376) in the Baptistery of the Cathedral of Padua, and Giovanni di Paolo's "The Creation of the World and the Expulsion from Paradise" (1445), Lehman Collection, Metropolitan Museum of Art, accession number 1975.1.31 (reproduced in Freeth & Jones 2012, Fig. 2).

23 We have omitted labels referring to the solstices and the autumnal equinox and identifying the horizontal and vertical lines as colures.

24 Images of the original manuscripts may be viewed at the Biblioteca Medicea Laurenziana's website, <http://teca.bmlonline.it> (by search for "plut.28.01" and "plut.09.28").

25 The numerals following the names of the Egyptian months are just the ordinal numbers of the months counting from the vernal equinox.

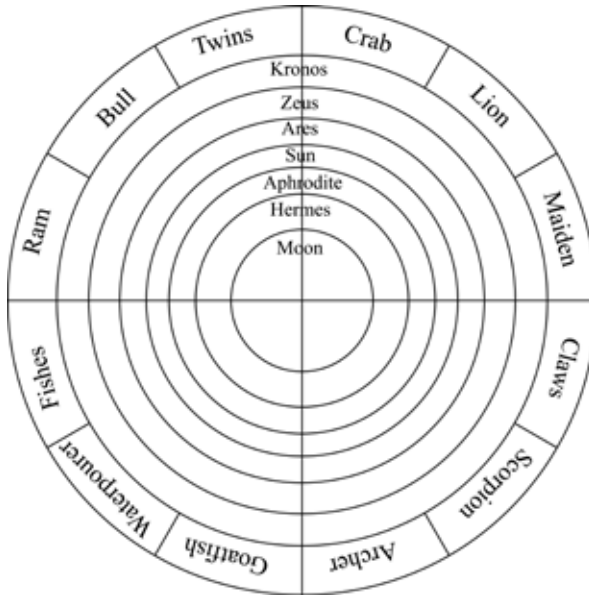


Figure 5.7: Redrawing of cosmological diagram from Laur. plut. 28.01, f. 176v.



Figure 5.8: Redrawing of cosmological diagram from Laur. plut. 9.28, f. 96r

Our contention is that the front dial of the Mechanism, as delineated in the Back Cover Inscription, was a mobile version of a geocentric cosmological diagram, in which the Sun and planets

were represented by small spherical symbols mounted on revolving pointers radiating from the dial's center (Fig. 3.1).²⁶ These spheres would have been set at successively increasing distances from the center, with the one for Mercury innermost and that for Saturn outermost. Right at the center, of course, was the revolving casing for the Moon, which displayed the Moon's phases through its own little sphere, in this instance not mounted on a pointer but seen through an orifice in the casing. The Earth might have been represented as a circular feature on the casing; the zodiac scale, engraved with the names of the zodiacal signs and the index letters linking to constellations, stood for the fixed stars, and the calendar scale provided the concordance with the Egyptian months.

Part I: description of the Mechanism's front face

3. The phrase δεῖδ' ὑπολαβεῖν ("one should understand") recurs (probably) at l.14. It probably introduced an injunction to the reader to interpret a particular feature of the front face in a certain astronomical way.

9. Possible completions are ἡρμόσθαι, "to have been fitted", or a form of the corresponding participle. We suppose this is likely to refer to a component fitted in a mechanical sense to some other component.

10. There is too little context to allow one to guess what component's extremity is referred to.

12. The mention of the color black probably was part of a description of the revolving Moon phase ball, which is presumed to have been half black, half white.²⁷ We conjecture therefore that a section of the text beginning somewhere before l.12 and ending at about l.16 was devoted to the apparatus in the center of the front dial that displayed the Moon's longitudinal motion as well as its phases.

14. Cf. l.3.

15. This "little sphere" is likely again the Moon phase ball.

16. αὐτοῦ ("it") probably refers to the cylindrical casing of the Moon phase display, and the pointer would be that for the lunar longitude, projecting from the rim of the casing close to the phase ball.²⁸

17. As already conjectured by Svoronos (1903a, 46 = 1903b, 46), the completion of the first word is obviously περιφερειῶν, "circular arcs" or "circumferences", meaning a partial or complete circular line. We suggest restoring the continuation as ἡ μὲν ἐχομένη τῷ τῆς Σελήνης κύκλῳ, "the (arc) next to the Moon's circle" (or some equivalent noun). We interpret the putative "Moon's circle" as the outline of the phase display casing, serving as an image representing the sphere of the Moon in a geocentric cosmology, and the "next" arc would therefore be a circular outline representing the sphere of the planet closest to the Earth after the Moon. It is not clear whether there was actually a plate behind the planetary pointers engraved

26 For a previous argument to this effect see Freeth & Jones 2012, 2.3.2. Wright 2012, 287 has also suggested that there were planetary pointers bearing small spheres ("globules").

27 Wright 2006, 319 and 327.

28 Wright 2006, 328.

with concentric circles for the planets' cosmological spheres, or their visualization was left to the viewer's imagination.

18. We conjecture that the first letters are the final syllable of Στίλβοντος, Stilbon or "Gleamer", the Hellenistic descriptive name of the planet Mercury (otherwise known by the theophoric name ὁ τοῦ Ἑρμοῦ ἀστήρ, "the star of Hermes"). The descriptive names of the remaining four planets (Phosphoros/Lightbearer = Venus, Pyroeis/Fiery = Mars, Phaethon/Radiant = Jupiter, Phainon/Shiner = Saturn) appear in I.19-20 and 23-25, in combination with the theophoric names, as frequently occurs in late Hellenistic and Roman period astronomical and astrological texts.²⁹ A reconstruction bridging the gap between I.17 and I.18 could be on the following lines: ἡ μὲν ἐχομένη τῷ τῆς Σελήνης κύκλῳ περιφέρεια κύκλος ἐστὶν τοῦ Ἑρμοῦ Στίλβοντος, "the arc next to the Moon's circle is the circle of Hermes Stilbon".

We conjecture that the noun following φερόμενον was σφαιρίον, "little sphere," as in I.21 and 25, and that this was a small spherical attachment on the planet's longitudinal pointer. On analogy with I.22, the statements about these spheres may have specified their colors, so that the viewer would easily be able to distinguish the pointers belonging to the heavenly bodies.

The rest of this line probably was something like ὑπὲρ δὲ τὴν τοῦ Στίλβοντος περιφέρειάν ἐστὶν κύκλος, "Above the arc of Stilbon is the circle" (cf. I.22).

19. The engraver definitely omitted the last letter of Ἀφροδίτη by mistake; there is no space for an effaced letter, and also no visible evidence of a correction of the error. For other errors see II.3, 5 (apparatus), and 21.

On analogy with I.18 and 23-25, the illegible letters following Φωσφόρου were probably τοδ, introducing the specification of the little sphere for Venus.

20. We conjecture that the words preceding this line were ὑπὲρ δὲ τὴν, "above the," and that the line continued by introducing the Sun's circle.

21. Unless there was an orthographical mistake such as γνώμωνι for γνώμωνι, one has to restore the nominative γνώμων, but then the syntax of this line is hard to reconstruct. The phrasing does not seem to parallel that for the planets very closely, perhaps because the way that the Sun was portrayed on the dial was in some way distinctive.

22. Mention of an ἀκτίς ("ray" or "brightness") of the Sun is enigmatic. Did this allude to a decorative feature? Or perhaps in some way an attachment to the pointer represented the zone of proximity to the Sun within which a planet would not be visible.

ὑπὲρ ("above"), we suggest, was to be understood in the figurative cosmological sense,

29 On the two systems of names see Cumont 1935. Whether or not Cumont was right in arguing that the descriptive names were invented in the Hellenistic period as a "scientific" replacement for the theophoric expressions, both were in use side by side as early as the 1st century BC (cf. Geminus, *Introduction to the Phenomena* 1).

that is, further from the center of the dial, to be interpreted as further from the Earth in the geocentric system.

The last preserved letters suggest κύκλος, "circle," used as an alternative to περιφέρεια, "arc". Judging by the space available on this line, more was said about this before its associated planet, Mars, was named in the next line.

23. Following a previously published conjecture,³⁰ we tentatively restore the remainder of the line as follows: τὸ δὲ διαπορευόμενον αὐτοῦ σφαιρίον πυρρὸν (?). ὑπὲρ δὲ Πυρόεντά ἐστιν κύκλος τοῦ, "and the little sphere making its way through it is fire-red (?). Above Pyroeis is the circle of...".

24. We tentatively restore: τὸ δὲ διαπορευόμενον αὐτοῦ σφαιρίον... ὑπὲρ δὲ Φαέθοντός ἐστιν ὁ τοῦ Κρο-, "and the little sphere making its way through it is.... Above Phaethon is the circle of Kronos....".

26. We suppose that the "cosmos" refers to the region of the front dial occupied by the little spheres and pointers for the heavenly bodies.

27. The "letters" are surely the alphabetic index letters on the zodiac scale that key solar longitudes to predicted visibility phenomena of constellations in the *Parapegma* Inscription.

28. It is not clear what is meant by ἀσιδίσκαί, "disks" or "bosses." In Heron, *Dioptra* 5-6 the word applies to disk-shaped visual targets used in land surveying. One possibility here is that they are the circular buttons in the four corners of the front dial plate, by which the sliding catches holding the plate in place were engaged or disengaged.

Part II: description of the Mechanism's back face

2. Lines II.2-16 apparently concern the upper spiral ("Metonic") dial of the back face.³¹ This is an exceptionally prolix treatment of a single dial, apparently motivated by the unusual format and the complexity of the pointer-follower. The inscriptions are described first (II.2-4), then the pointer and its operation.

The διαίρεσεις ("divisions") mentioned in this line were probably the radial division strokes dividing the scale of the spiral into cells for the calendar months.

3. The number 235 is determined by the Metonic relation 235 lunar months = 19 solar years, and the remains of the dial on Fragment B suffice to confirm that there were indeed 235 cells.³² Note the omitted iota adscript (cf. II.21) and the short horizontal stroke over the numeral, the only definite instance in the Mechanism's inscriptions of this generally common way of indicating a cardinal numeral.

4. The "omitted" days were the day numbers in specified calendar months of the Metonic cycle that were to be skipped over so that an appropriate number of months would have

30 Freeth & Jones 2012, 2.3.2.

31 Wright 2005.

32 Wright 2005, 10.

twenty-nine days instead of thirty. These numbers were inscribed inside the innermost turn of the spiral slot.³³ ἔξαιρέσιμος was a technical term for such skipped days, found elsewhere only in Geminus, *Introduction to the Phenomena* 8 (where a scheme for their distribution in a Metonic cycle similar but not identical to that of the Mechanism is prescribed) and in pseudo-Aristotle, *Oeconomica* 1351b15, an anecdote about the fourth century BC mercenary leader Memnon of Rhodes. Memnon is said to have deducted the equivalent of six days' pay *per annum* from his soldiers' wages on the pretext that they did not have to do any work on these "omitted" days.

5. Lines II.5-7 describe the apparatus by which the pointer-follower was mounted at the axial center of the spiral dial. Attached to the axle was a circular disk (τυμνάιον — in mechanical texts the same word, when qualified with ὀδοντωτόν, "toothed," means "gear") riding just over the surface of the Back Plate. Two upright bearings (στημάτια) were attached in diametrically opposite positions near the perimeter of the disk, and the shaft of the pointer-follower passed freely through rectangular perforations (τρήματα) in the bearings. Remains of this mounting surviving in Fragment B were identified by Magdalini Anastasiou.³⁴

The engraver initially inscribed the singular στημάτιον, "bearing", and then, before going further, corrected by engraving alpha superimposed on the omicron and the delta of δύο on the nu. This *currente calamo* error and correction is interesting as showing that the text was not first written on the plate in paint or scratched wax but engraved immediately from a separate exemplar.

9. συμφύξ, "fused" or "attached," is the conventional vocabulary for mechanical components attached to other components so that they have no freedom of independent movement. It is not clear what is spoken of in this way in this and the following line.

14. Despite the miserable condition of the preceding lines, it appears that this passage describes how the pointer-follower traces the spiral groove from its innermost extremity to its outermost (perhaps this is what is "opposite" here).

15. The pointer-follower as currently understood had three elements that could have been described as a "pin" (πρόννη): the projection that rode in the spiral slot; a horizontal, sharp-ended pin that sticks out from the pointer's end; and a larger rod that held together the components of the bearing.³⁵ It is not clear which one is meant here; the text seems to be describing an operation connected with the resetting of the pointer-follower to the beginning of its spiral, in which the pin in question was temporarily removed from its setting and then replaced, seemingly a lynch-pin whose removal would facilitate the lifting of the pointer out of the slot.

16. Possibly the first cell of the Metonic spiral scale.

17. This passage (II.17-19) proves that there were in fact two subsidiary dials within the

33 Freeth, Jones, Steele, & Bitsakis 2008, 614-615.

34 Anastasiou 2014, 42-46; Anastasiou, Seiradakis, Carman, & Efstathiou. 2014, 3-5.

35 Anastasiou, Seiradakis, Carman, & Efstathiou 2014, 3-5.

Metonic spiral, one of which is the extant “games” dial whose pointer revolves once in four years’ motion, while the other, now entirely lost, had a pointer revolving once in 76 years’ motion.³⁶ Both were divided into four equal sectors (II.18), respectively counting years in the four-year cycle and Metonic 19-year periods in the 76-year Callippic cycle.

18. The subject of δηλοῖ is probably κύκλος, “circle,” i.e. “dial.” The text can be tentatively restored as follows: δηλοῖ δ’ ὁ μὲν τὴν τῆς (τετραετηρίδος) (ἔτος), “one of (the dials) shows the year of the four-year cycle”. On analogy with the next line, τετραετηρίδος and ἔτος would probably have been abbreviated as δL and L.

19. One has to presume ὁ δὲ (“while the other”) towards the end of the preceding line. The abbreviations οςL and ιθL must be interpreted respectively as ἑκκαεβδομηκονταετηρίδος and ἔνεακαιδεκαετηρίδα, a flexible reading of the L symbol for ἔτος, “year”, not attested elsewhere.

20. The text has now turned to the lower spiral dial, with its 223 divisions for the lunar months in a Saros cycle.

21. It is not clear what division is referred to here, since the division of the spiral scale into 223 cells has apparently been dealt with in the preceding line.

22. This line, unfortunately not well preserved, must be describing the “glyphs” or abbreviated predictions of solar and lunar eclipse possibilities in cells of the Saros scale. The restoration χρόνοι, “times”, is tempting.

23. Likely to be restored ὁμοίως τοῖς ἐπὶ τῆς ἐτέρας ἑλικος, “similarly to the... on the other spiral”, a phrase that may indicate that the same apparatus for the pointer-follower was here too.

24. Paralleling II.17, the text was probably γνωμόνιον οὗ τὸ ἄκρον φέρεται, “a little pointer whose tip travels”. This must refer to the lower subsidiary dial tracking the *exeligmos* (triple Saros) cycle, and the singular noun shows that there was in fact only one subsidiary dial here.

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36 Wright 2005, 10-11 proposed that the extant subsidiary dial on Fragment B was a Callippic cycle dial. Freeth, Jones, Steele, & Bitsakis 2008, supplementary notes 19-23 identified the extant dial as displaying a four-year cycle, but conjectured that there was also a Callippic cycle dial on the lost left side of the Metonic dial’s center.

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