Greenwich Hour Angle Calculations using Lindbergh-Weems Second-Setting Watch

Examples and Simulation Graphics by Edward Popko

Dial and Time Hand Functions

- Bezel rotates to compensate for whole minutes of Equation of Time (EoT). Rotate counter clock-wise when positive, clock-wise when negative. If EoT is 00:00, align bezel 15º mark with 12:00 dial
- Hour hand reads whole degrees from face dial (is performing hrs*15 degrees)
- Minute hand reads degrees and whole 15/30/45 minutes arc from bezel
- Second hand reads arc minutes and seconds (dots between arc minutes) from central dial
- Center dial tick displays additional EoT seconds correction to GHA's arc minutes and seconds (dots between arc minutes) to be added for +EoT or subtracted if -EoT

Finding GHA

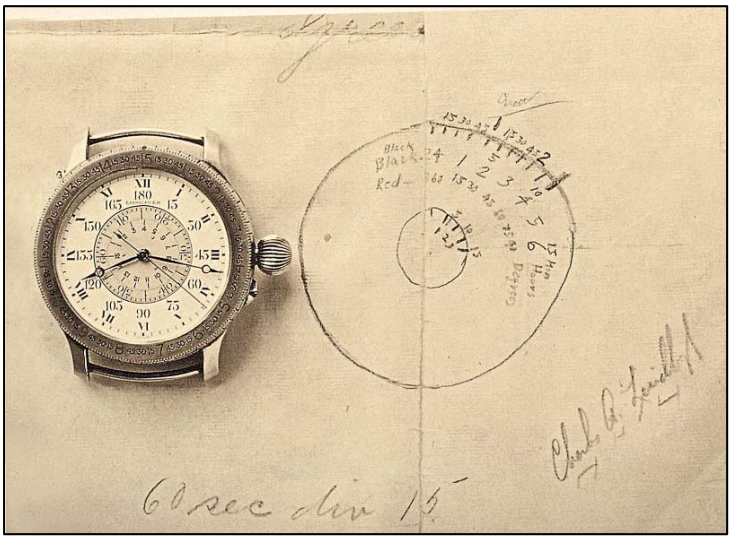
1. Bezel is already set for EoT minutes (see above)
2. If GMT (displayed on a 12-hour watch face) is AM, start list with 180º. GMT is on lower meridian at midnight, GHA is measured west from Greenwich Meridian. For PM GMT display, no correction is needed.
3. Read hour hand, whole degrees of arc from main dial, add to list.
4. Read minute hand, whole degrees plus any whole increment of 15/30/45 arc-minutes from bezel. Add to list. Note that if minute hand is left of 15º bezel mark, use one hour less in step 3.
5. Read second hand on central dial, whole arc-minutes and whole 14/30/45 arc-seconds (dots between arc-minutes). Add to list.
6. Read central face EoT tick mark. This last correction never exceeds 15" arc. Sign is positive if EoT is positive, negative otherwise. Note that EoT minutes, if any, were set on bezel, its rotation clock or counter-clock wise depends on EoT's sign.
7. GHA is sum of list

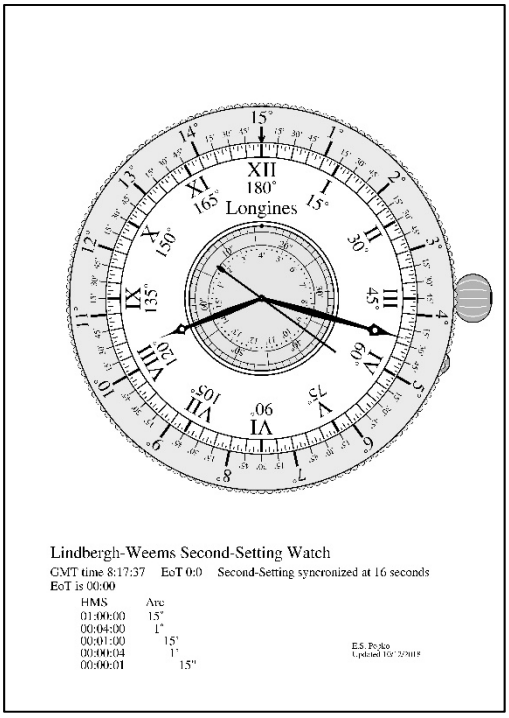
Concept Drawing for Longines' Second-Setting Watch GMT 08:17:37 EoT 00:00[2]

No bezel or center dial compensation for EoT. Second-Setting center face rotation 16 seconds for synchronizing the second hand at zero seconds.

180º	sun is on the lower meridian at midnight
120º	hour hand
4º 15'	minute hand
+ 9' 15"	second hand

304º 24' 15"	GHA





[2] Photo: www.hautetime.com/celebrating-the-lindbergh-hour-angle-watch-with-longines/83312/, Graphic: Lindbergh-Weems Second-Setting Watch v8 Sketch.jpg

Photo of Original Longines' Second-Setting Watch GMT 10:10:09 EoT 00:00[3]

No bezel or center dial compensation for EoT. No documentation indicating an Equation of Time. Second-Setting center face rotation is likely synchronizing the second hand at zero seconds.

180º	sun is on the lower meridian at midnight
150º	hour hand
2º 30'	minute hand
+ 2' 15"	second hand

332º 32' 15"	GHA

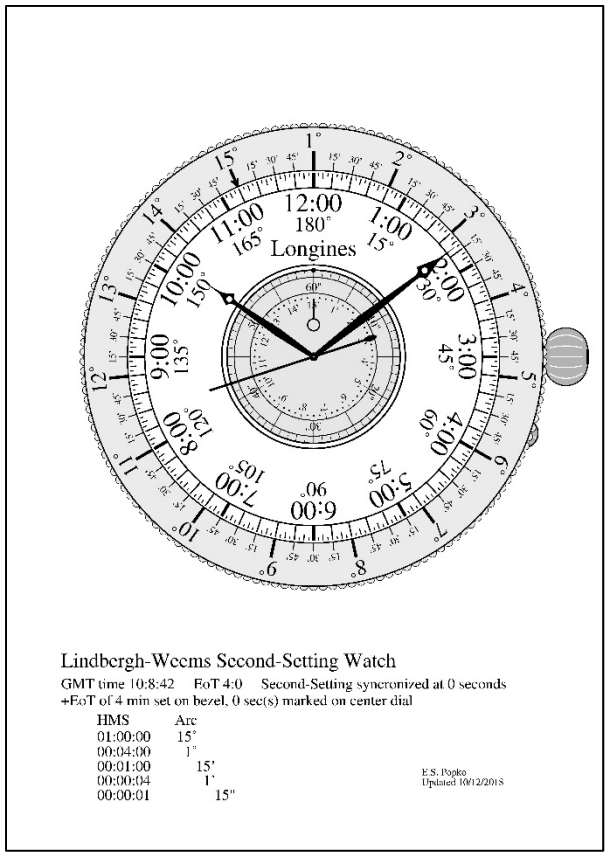
[3] Photo: www.hautetime.com/celebrating-the-lindbergh-hour-angle-watch-with-longines/83312/

Lindbergh Hour Angle Watch GMT 10:08:42 EoT +04:00

Bezel counter clockwise 4 minutes for +EoT, no seconds on center dial.

180º		sun is on the lower meridian at midnight
150º		hour hand main dial
3º		minute hand bezel dial
+	10’ 30”	second hand center dial

333º	10’ 30”	GHA



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[4] Longines promotional photo, www.longines.com/watches/heritage-collection/l2-678-4-11-0, Graphic: Lindbergh-Weems Second-Setting Watch v8 Ex 18.jpg

Gary LaPook's Example GMT 01:08:45 EoT -03:40[5]

Bezel clockwise 3 minutes for -EoT, 40 seconds on center dial (marked)

180º		sun is on the lower meridian at midnight
15º		hour hand main dial
1º 15'		minute hand bezel dial
	11' 15"	second hand center dial
+	-10'	center dial EoT seconds compensation, negative sign since slow
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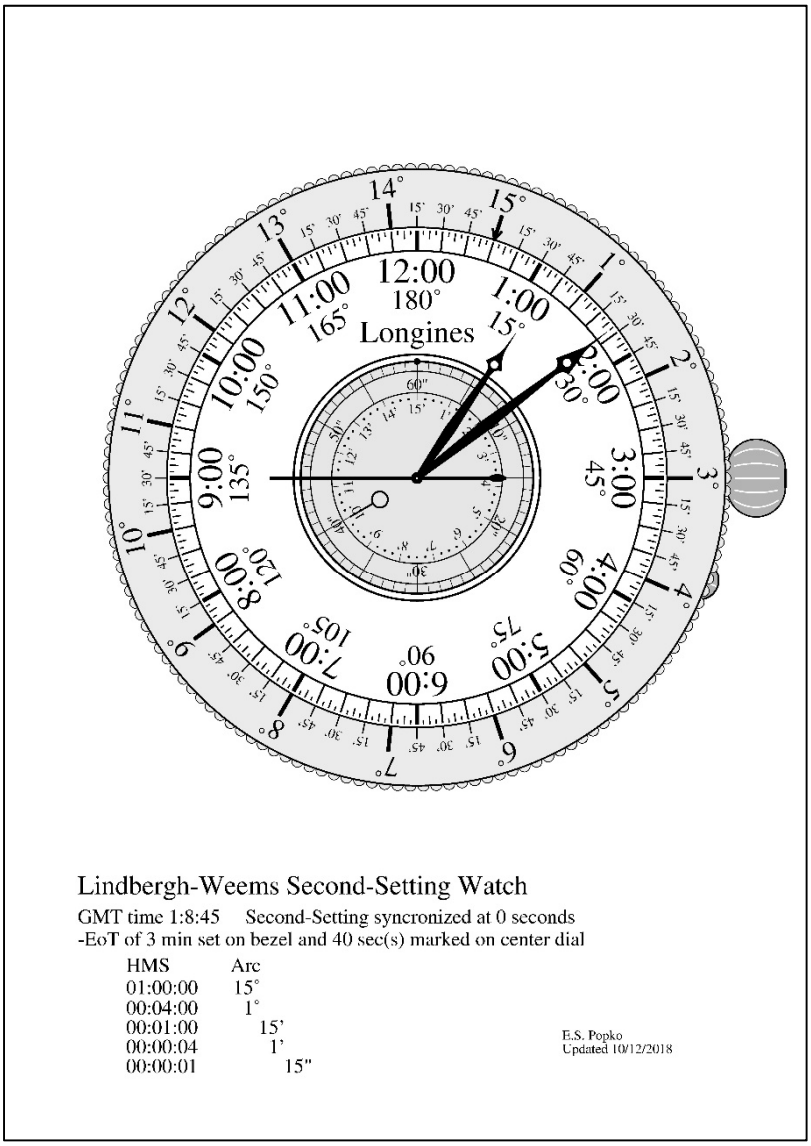
196º 16' 15"		GHA



[5] Graphic: Lindbergh-Weems Second-Setting Watch v8 Ex 12.jpg

Longines Watch Guide Example GMT 04:37:12 EoT -04:50[6]

Bezel clockwise 4 minutes for -EoT, 50 seconds on center dial (marked)

180º sun is on the lower meridian at midnight
60º hour hand main dial
8º 15' minute hand bezel dial
3' second hand center dial
\+ -12' 30" center dial tick EoT seconds compensation, negative sign since slow
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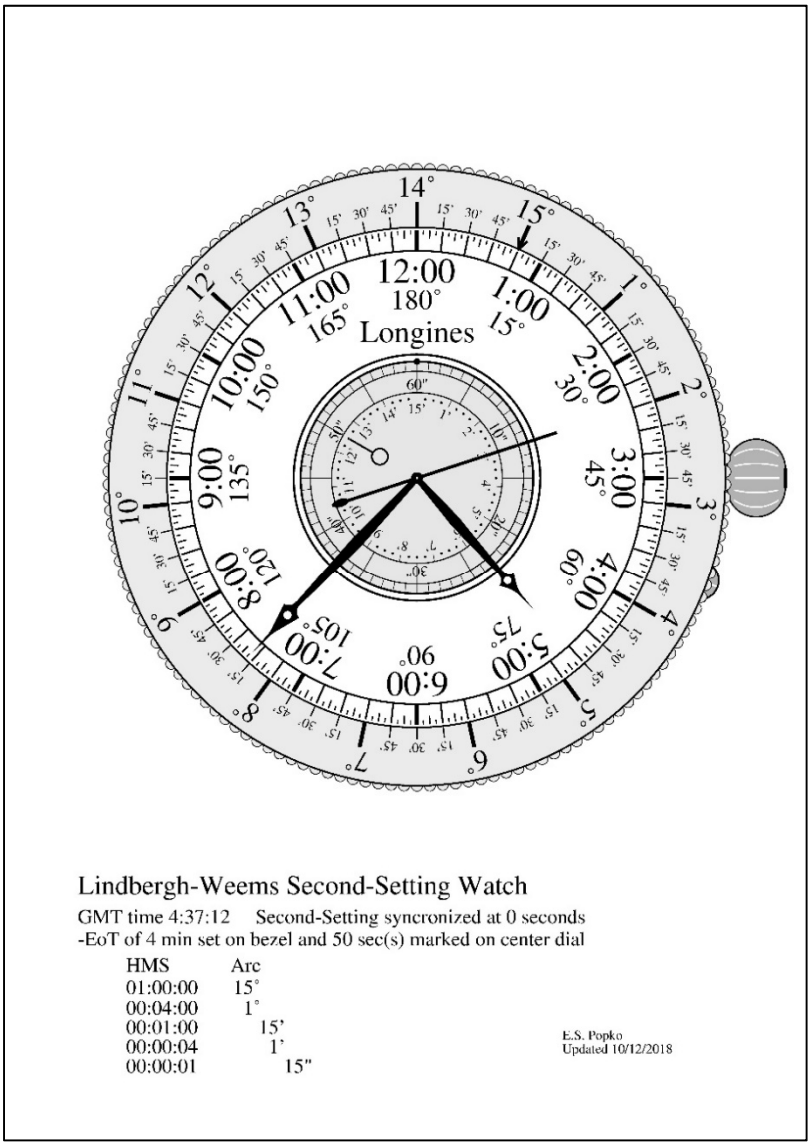
248º 05' 30" GHA



[6] Graphic: Lindbergh-Weems Second-Setting Watch v8 Ex 10.jpg

Important Example GMT 10:07:24 EoT -12:01[7]

Bezel clockwise 12 minutes for -EoT, 01 second on center dial (marked)

When the minute hand points left of bezel 15º mark, you must subtract one hour from hour hand!

180º	sun is on the lower meridian at midnight
135º	hour hand at 150º, but use 135º because minute hand is left of 15º bezel mark
13º 45’	minute hand bezel dial
6’	second hand center dial
+ -15”	center dial tick EoT seconds compensation, negative sign since slow
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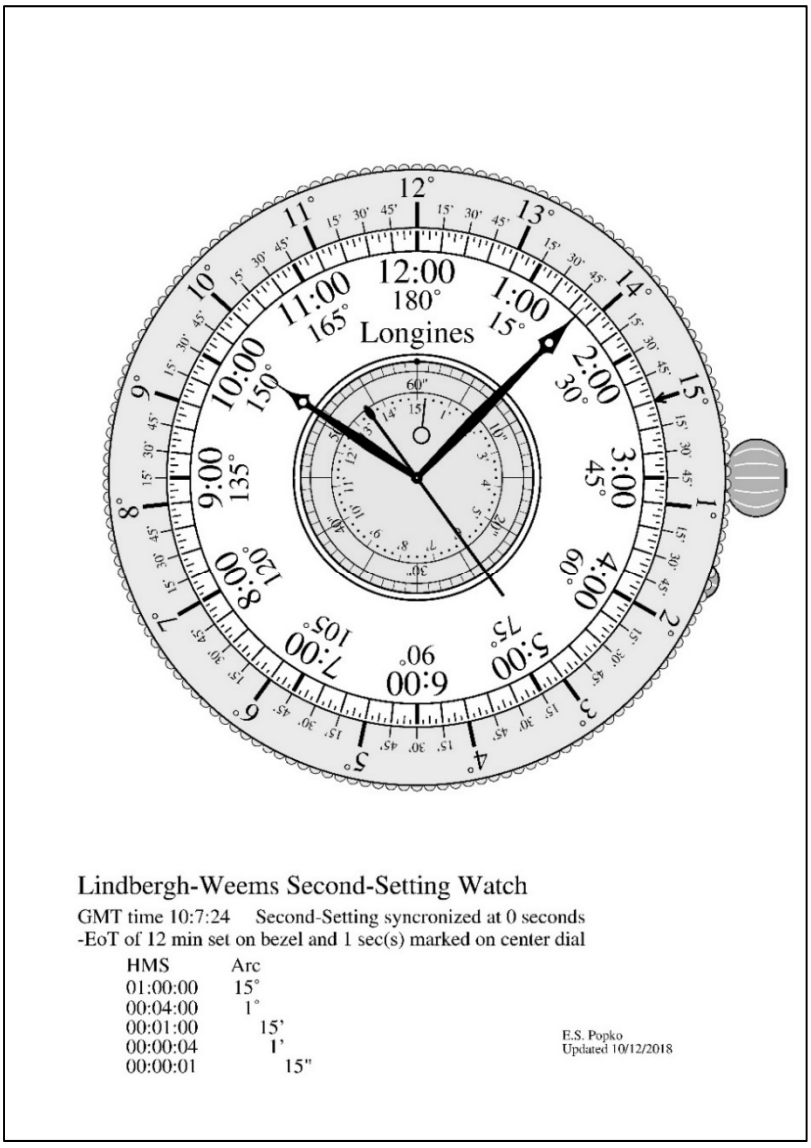
328º 50’ 45”	GHA



[7] Graphic: Lindbergh-Weems Second-Setting Watch v8 Ex 13.jpg

GMT 00:08:45 EoT -03:40[8]

Bezel clockwise 3 minutes for -EoT, 40 seconds on center dial (marked)

180º	sun is on the lower meridian at midnight
0º	hour hand less than a full hour main dial
1º 15”	minute hand bezel dial
11’ 15”	second hand center dial
+ -10’	center dial tick EoT seconds compensation, negative sign since slow
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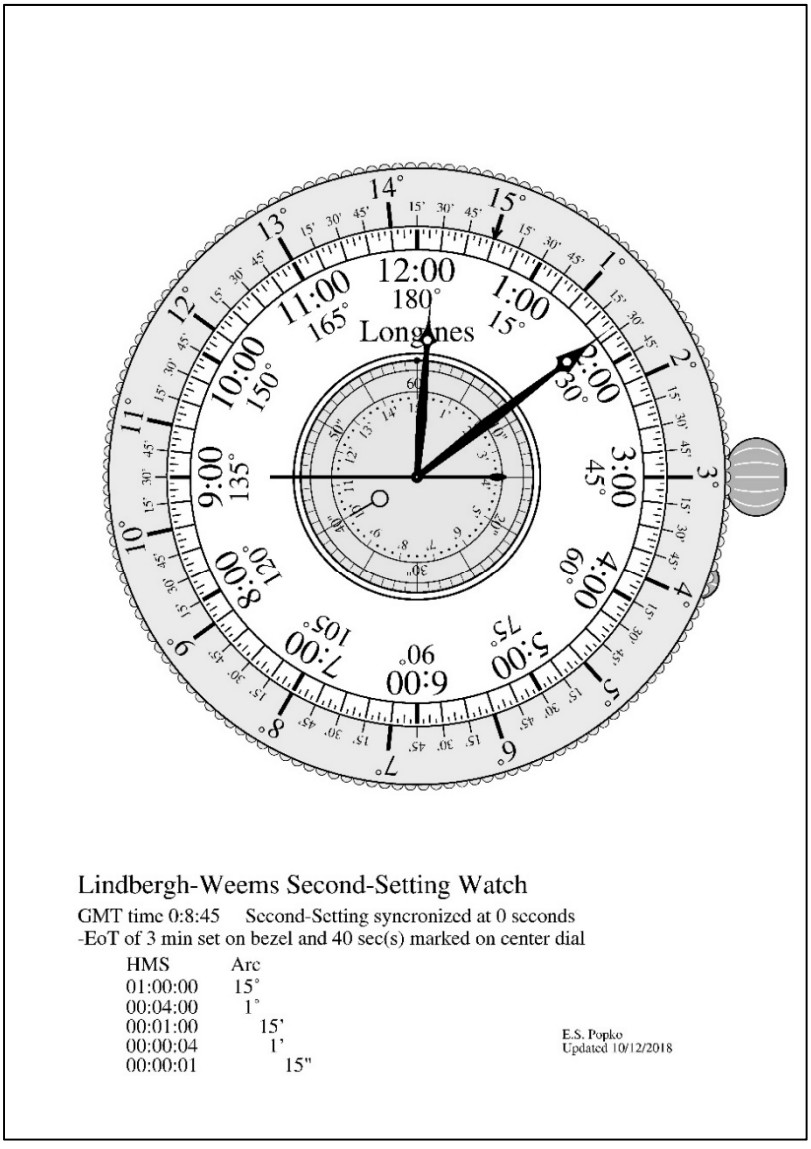
181º 16’ 15”	GHA



[8] Graphic: Lindbergh-Weems Second-Setting Watch v8 Ex 17.jpg

GMT 19:14:08 EoT +15:40[9]

Bezel counter clockwise 15 minutes for +EoT, 40 seconds on center dial (marked)

105º hour hand less than a full hour main dial
7º 15’ minute hand bezel dial
2’ second hand center dial
\+ +8’ 45” center dial tick EoT seconds compensation, negative sign since slow
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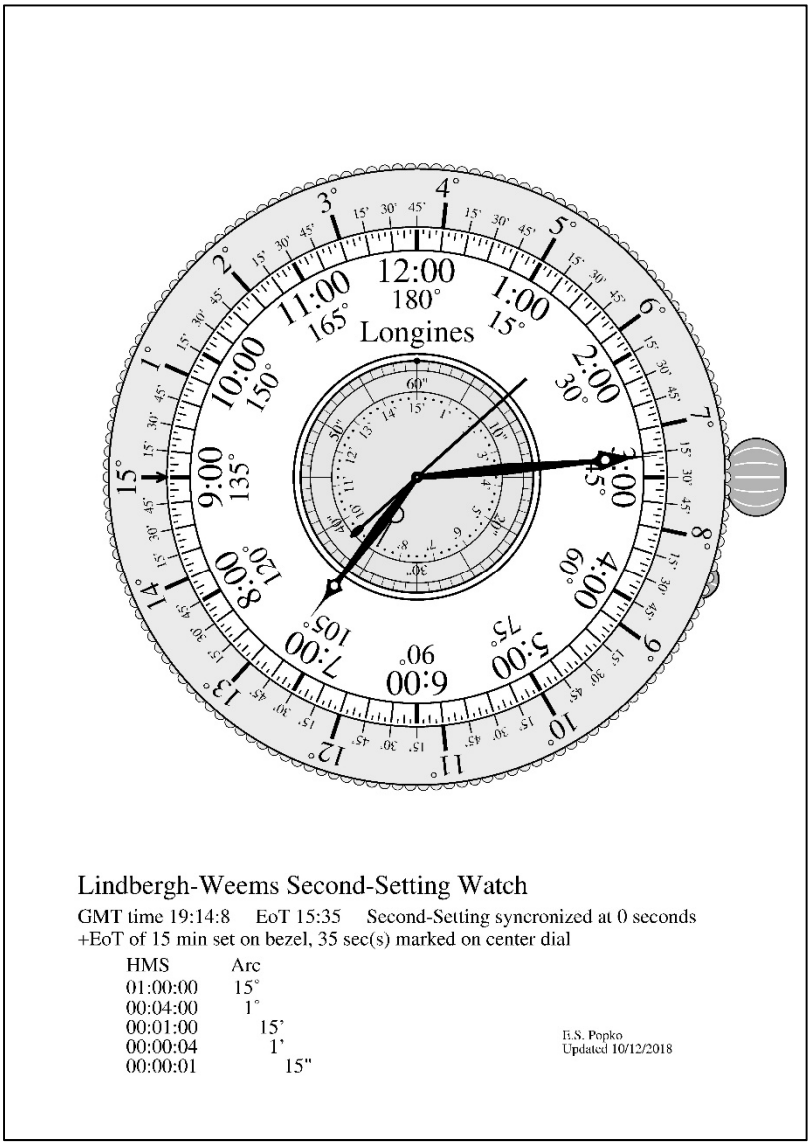
112º 25’ 45” GHA



[9] Graphic: Lindbergh-Weems Second-Setting Watch v8 Ex 20.jpg

Longines Guide to Lindbergh Hour Angle Watch Instructions[10]

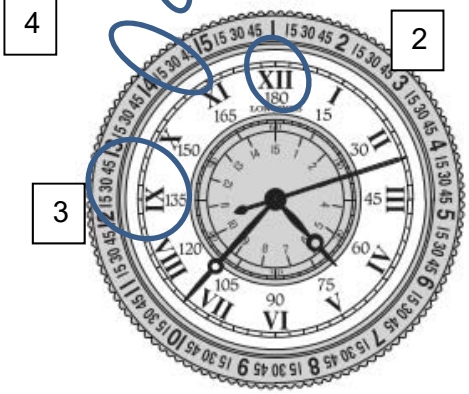
L614, L699 – THE LINDBERGH HOUR ANGLE WATCH LONGINES

Consequently:

The hour hand indicates 15° per hour. One complete circle of the dial (12 hours) is equivalent to 180°.

The minute hand indicates 1° per 4', in other words 15° per hour. Each of the 15° is subdivided into four sectors of 15' of arc. All these indications are engraved on the rotating bezel.

One co[illegible]e circle of the centre seconds is equivalent to 15' o[illegible] The rotating central dial is divided into 60" and 15' of arc.



How to use your Lindbergh Hour Angle Watch

Having synchronised your watch with a time signal. As an example when you check it your watch shows 4 hours, 37 minutes and 12 seconds. The equation of time for the day in question is minus 4 minutes and 50 seconds.

Therefore move the marker situated at "15" on the bezel 4 graduations to the left. [1] e graduations represent the minutes engraved ar[illegible] the case.

Your data are as f[illegible]s: [2]

Seconds hand (centre dial) [3]		3'
Minute hand (bezel)	10°	15'
Hour hand (main dial)	60°	

As you have only turned the bezel by 4 minutes, you still have to take into account the 50 seconds (the equation of time be[illegible] [4] 4 minutes and 50 seconds for the day question).

On the central dial, the 50 is opposite 12½	./.	12½'
Greenwich hour angle of the sun **(your longitude)**	70°	5½'

78 Self-winding watches

[10] Longines' Lindbergh Hour Angle Watch Users Guide, www.longines.com/watches/heritage-collection/l2-678-4-11-0