OE and mark the point *L* corresponding to the dial's intended latitude; the length *OL* is $\sin\varphi / \sqrt{1+\sin^2\varphi}$. Place the *Hour* scale so that its entire length lies between *L* and a point *M* on the north line; the length *LM* is therefore 1, and by the Pythagorean theorem, the line *MO* is $1/\sqrt{1+\sin^2\varphi}$.

The point on the *Hour* scale *ML* corresponding to time *t* is *B*. By the design of the *Hour* scale, we know the length *MB* is $\sin t / (\cos t + \sin t)$; and the resulting complementary length *BL* is $\cos t / (\cos t + \sin t)$. The hourline for time *t* is *OB*.

To prove that this construction is valid, it suffices to establish that $\tan AOB = \tan t \sin\varphi$, thus satisfying the familiar formula for a horizontal dial.
Triangles *MOL* and *MAB* are similar, so $AB / MB = OL / ML$, and $AO / MO = BL / ML$. Given that *ML* = 1, we obtain the desired result as follows:

$$AB = MB \times OL = \sin t \sin\varphi \Big/ (\cos t + \sin t)\sqrt{1+\sin^2\varphi}$$

$$AO = MO \times BL = \cos t \Big/ (\cos t + \sin t)\sqrt{1+\sin^2\varphi}$$

and $\tan AOB = AB / AO = \tan t \sin\varphi$.

What Latitude Was It Designed For?

Steven Woodbury

In your rambles as a dial hunter you come across an interesting sundial installed in a garden. Your protractor or inclinometer shows that the gnomon makes the correct angle for your latitude. But the gnomon looks like a replacement, and you want to know whether the dial plate was designed for that latitude. You didn't bring your calculator ... or maybe you can never quite remember the trigonometry.

Serle's dialing scales can solve your problem. They are designed for constructing new dials, but with a little "reverse engineering" they can be used to determine the latitude for which an existing dial plate was originally designed. (These instructions are for the common case of a horizontal or south-facing vertical dial, with a flat dial plate, and no longitude correction.)

Step 1. On a tracing or rubbing of the dial plate, draw the "six o'clock" line, connecting 6:00 AM and 6:00 PM. Draw the "twelve o'clock" line (at a right angle). (Usually this is the edge of the base of the gnomon.) From the intersection of these two lines to the hour marks draw radial hour lines. Note that if the design of the dial plate already incorporates these lines, the tracing will not be necessary, and the reading can be taken directly from the dial.

Step 2. Place Serle's "Hour" scale on the tracing, with the zero end on the "twelve o'clock" line, and the "6" end on the "six o'clock" line. Slide and pivot the scale, keeping the end points on these lines, until the hour marks on the scale make the best match with the radial hour lines on the dial plate (see Figure 1). Mark the point on the "six o'clock" line where the hour scale touches it.

Step 3. Use Serle's "Lat." scale to measure along the "six o'clock" line from the "twelve o'clock" line to your mark. This gives a direct reading of the latitude for which the horizontal dial was designed (see Figure 2). If you are measuring a direct south vertical dial, this result is the complement of the latitude (*i.e.* latitude = 90 degrees minus this result).

I have made copies of Serle's dialing scales in several different sizes on acetate and heavy paper, which I carry in my "dial hunter's kit" for this purpose.

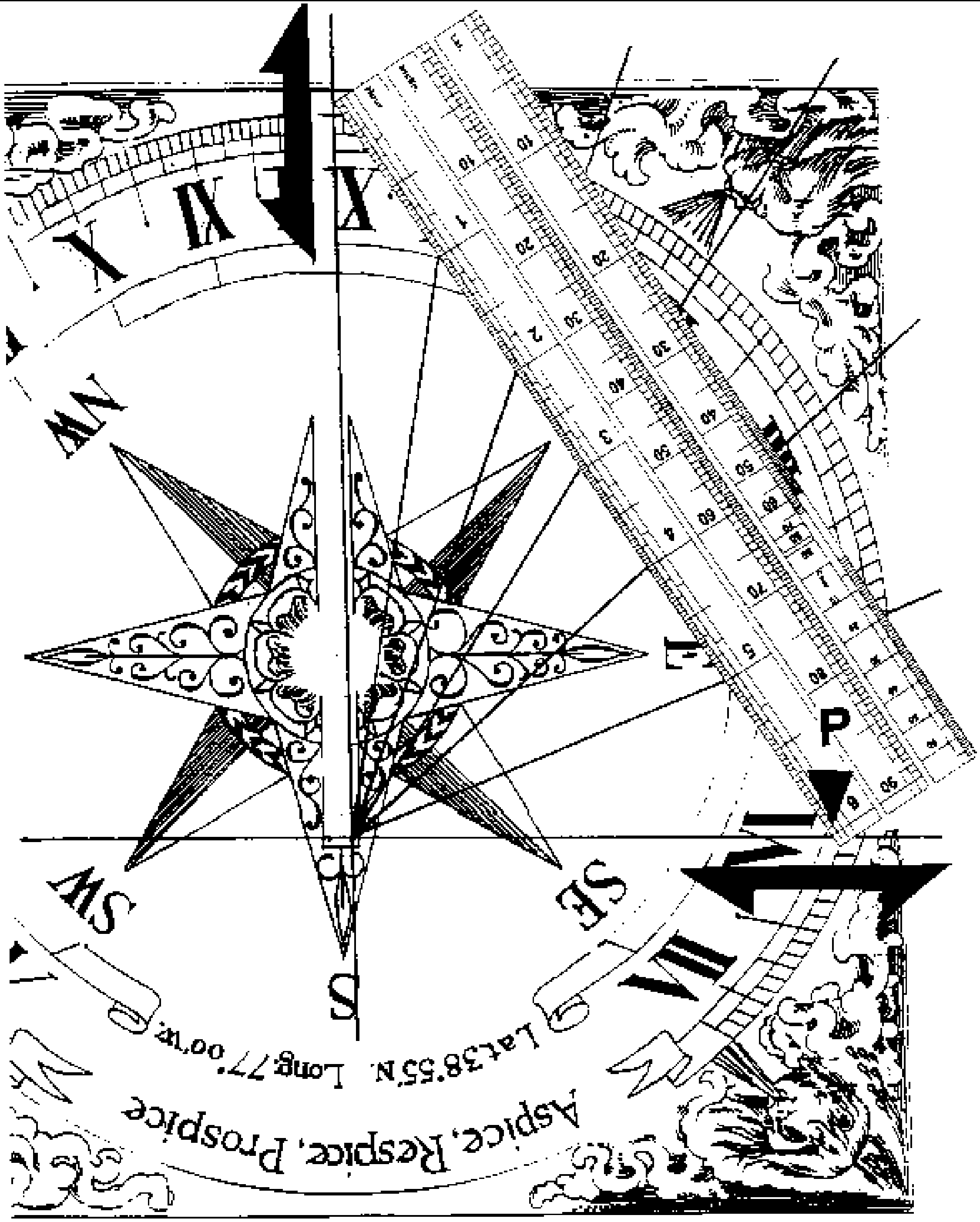

Figure 1

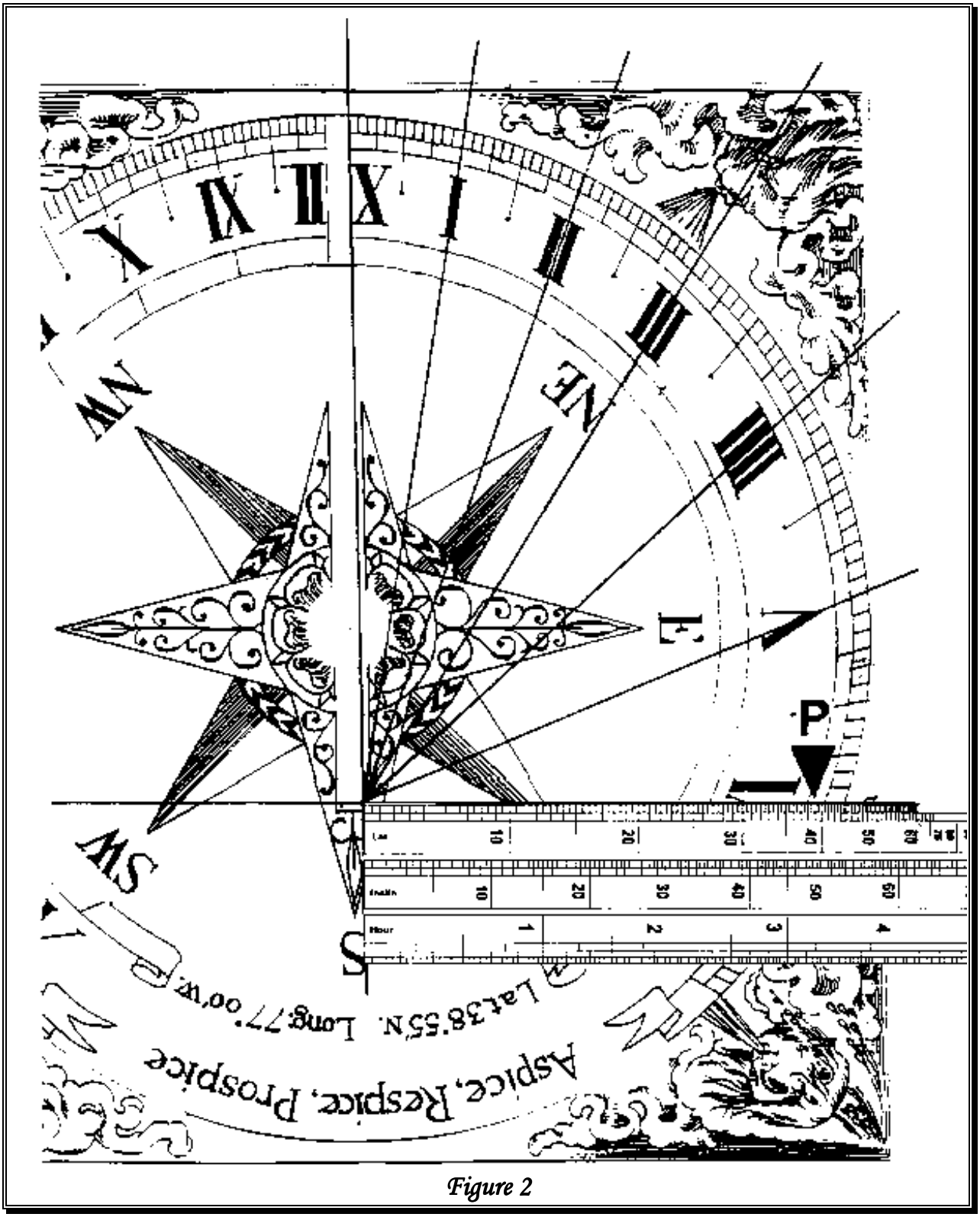
XII I II III IV V VI VII VIII IX X XI
NW
NE
E
P
S
SW
Aspice, Respice, Prospice
Lat 38.55N. Long 77.00W

Figure 2