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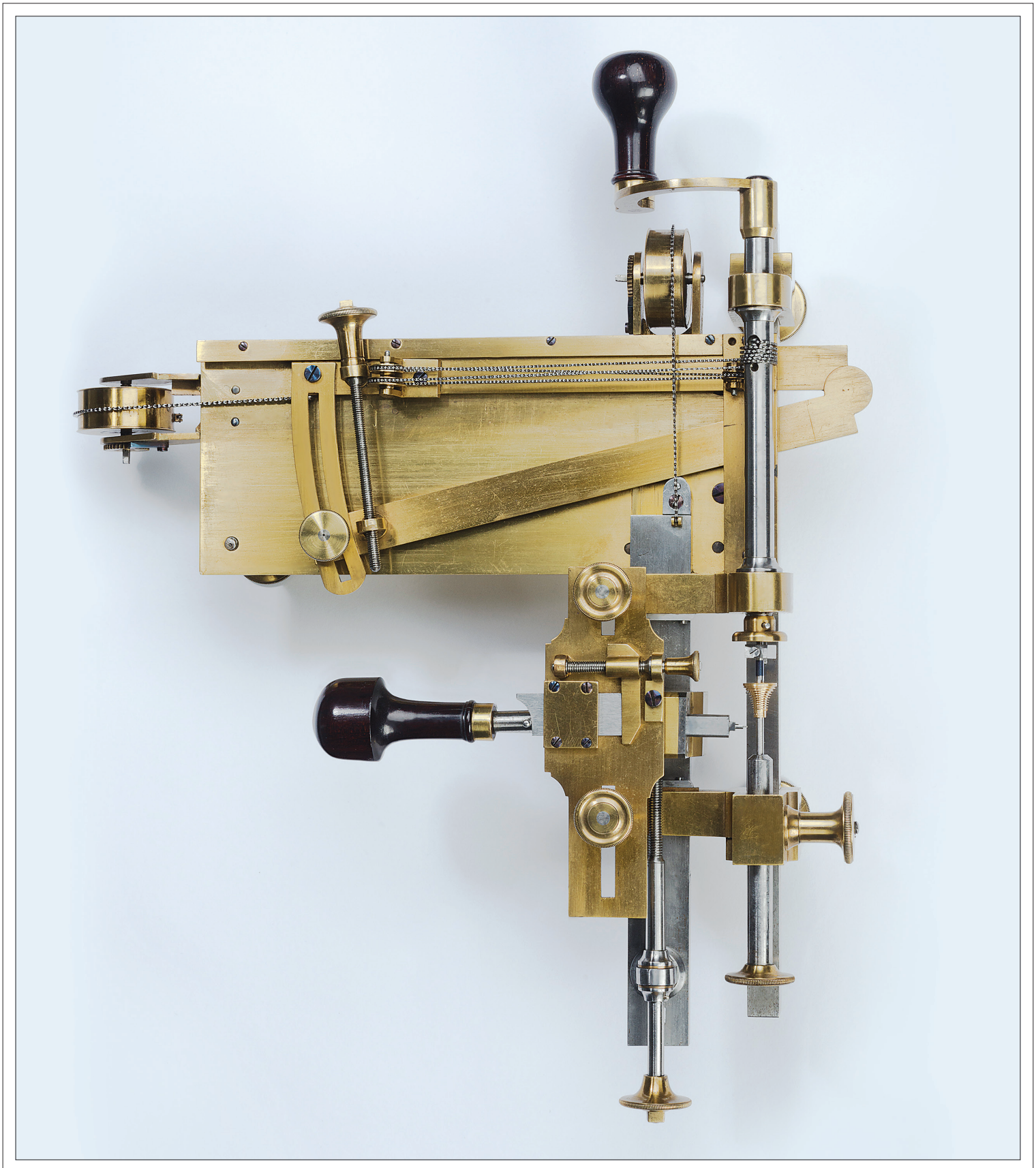

Making Your Own Tools 6

A Rotary Controller and a Universal Pillar Tool

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Rotary Controller

A rotary controller is an electronic dividing device that uses a stepper motor to drive the worm of a conventional rotary table, dividing head or other such machine. The one I made, about 20 years ago, was called a Division Master and is still in use, but no longer available. The one I will describe in this article is made and sold by Steve Ward[1] and performs similar functions. It is available in a range of forms, from a kit of components to a complete item, as shown in **Figure 1**, and there is comprehensive information on the website. Unless you have suitable tools, including a soldering iron with a fine tip, and are practiced in building such electronic items, I recommend buying the complete item.

Housed in a die-cast case, it incorporates a 5.6A stepper motor driver with connection via a four-pin XLR socket, which is the standard for stepper motors. Power is supplied by a separate 24-volt unit.

Figure 1. The rotary controller. Image provided by Stephen Ward.

Figure 2. A stepper motor applied to a rotary table. Image provided by Stephen Ward.

Features include:

- Jog mode, in which the table can be moved clockwise or counter-clockwise in 0.01, 0.1, 1.0 and 10.0 degree steps.
- Division mode, in which a circle may be divided into any number of divisions from 1 to 9999 inclusive.
- Degree mode, in which movement can be programmed in any number of degrees from 0.01 to 359.99 in 0.01 degree steps.
- Continuous drive mode, in which the table may be driven continuously clockwise or counter-clockwise at one of five selectable speeds.
- Gear cutting mode, in which there is provision to drive a second axis, thus to facilitate automatic gear cutting.
- Program mode, which allows complex sequences to be carried out (up to ten programs can be stored).
- It is configurable for any drive ratio from 1:1 to 9999:1. This enables it to cope with devices that use unusual ratios, including those that utilise the bull wheel of a lathe headstock. The software does all the hard work!
- It is configurable for all common stepper/driver combinations.
- It incorporates an interface, which allows it to be integrated into a CNC system to provide an additional axis of control.
- The device incorporates backlash compensation.

Figure 2 shows the stepper motor with small rotary table, while **Figure 3** shows this combination used to provide division drive to the headstock of a lathe. **Figure 4** shows a shop-made worm drive made from odds and ends fitted to the headstock of a small lathe. In **Figure 5** we see a batch of three 120-tooth escape wheels for the RAS replicas being cut on a milling machine at Upton Hall, with the late Ken Johnson at the controls and Tony Temple keeping a watchful eye on the process. Note the old Division Master on the swarf tray.

Is it worth the trouble? If you intend to cut wheels with unusual numbers of teeth, such as may be required to provide precise astronomical indications, or you wish to pin a musical

Figure 3. A small rotary table used to drive a lathe headstock to provide divisions. Image provided by Stephen Ward.

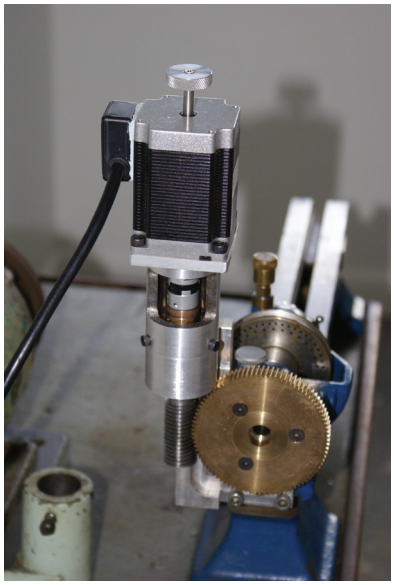

Figure 4. A home-made lathe headstock drive.

Figure 5. Cutting a 120-tooth escape wheel at Upton Hall. Pictured here are Tony Temple and the late Ken Johnson.

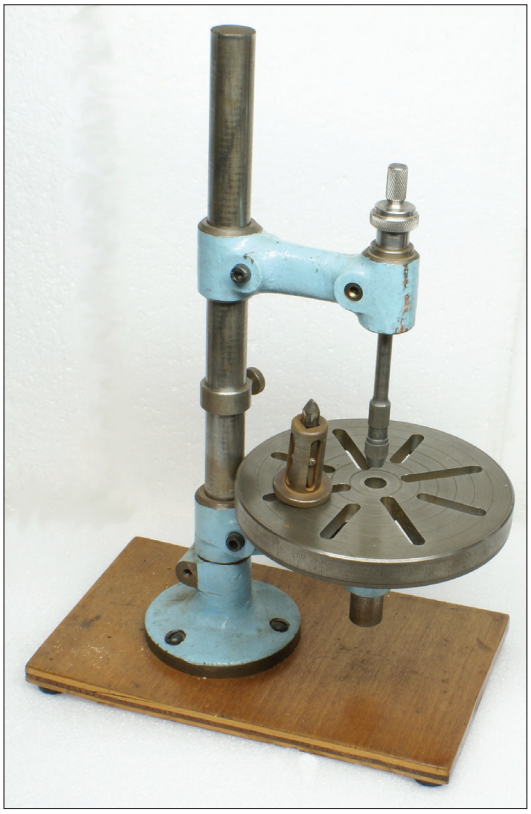

Figure 6. The basic UPT.

Figure 7. The tool with sensitive drill fitted.

barrel, then such a device is indispensable. Even if you don't want to do such things, it is very useful as it removes one of the sources of error in dividing work. It is one of those things that you won't need often, but is well worth having when you do.

Universal Pillar Tool

The UPT was designed by George Thomas and can be obtained as a series of kits from Hemingway Kits. It is described fully in the books *Building The Universal Pillar Tool*[2] and *Workshop Techniques*[3].

The basic tool is shown in **Figure 6**, in which the tool is holding a tap perpendicular to a work piece to ensure a true thread. This is available as a basic kit[4]. The item standing on the table is a holder for letter and number stamps and is described in the books. This item is very useful as it holds the stamps truly vertical to the work and helps to ensure the characters are stamped evenly.

Figure 7 shows the tool fitted with the sensitive drilling head, also available as a kit[5]. This is ideal for drilling small holes (under 1 mm) and has a depth stop. The only variation

I would recommend is to avoid the use of heat-bonded polypropylene belts. In my experience, these have a propensity to come apart at the most inopportune moments and I use small V-belts, such as those supplied by Gates[6] or Optibelt[7].

Further adaptors are available that allow the pillar to be attached to the bed of a lathe[8], one that provides a stake with a range of holes[9] and another which converts the basic tool into a clock bushing tool[10].

Is it worth the trouble? Definitely – I have used this a great deal since making it, especially while doing the DLC.

Construction is relatively demanding: in particular it is necessary to bore the holes in the supporting arms and the body of the drilling head truly parallel and it is desirable that they be at the same separation. I did this by making a jig to hold the parts on the faceplate of my lathe. As mentioned in earlier articles, I have used M6 cap screws in place of the ball-ended handles with which the tool was designed. It has also been pointed out to me that knobs are available that fit on to cap head screws, and these are a good alternative[11].

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8. Hemingway Kits, *www.hemingwaykits.com*, ref. alloy foot, HK 1268.
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11. RS, *uk.rs-online.com/web*, search for 'clamping knobs'.

Author's Note

Thanks to Bernard Whitworth for the information about clamping knobs.