EARLY CLOCKMAKERS' WORKSHOPS
Part 1. Jost Amman's woodcut

by John Robey, UK

Many books that discuss the history of horology include the woodcut by Jost Amman and the copperplate engraving by Joanus Stradanus that show early Continental clockmakers' workshops. In many instances they are included just as interesting illustrations, but with little, or no, informed consideration of what they depict. One of the few discussions on these, and some other early illustrations, was an article by the late Charles Aked, in CLOCKS magazine, way back in March 1986. Long-standing readers may wish to

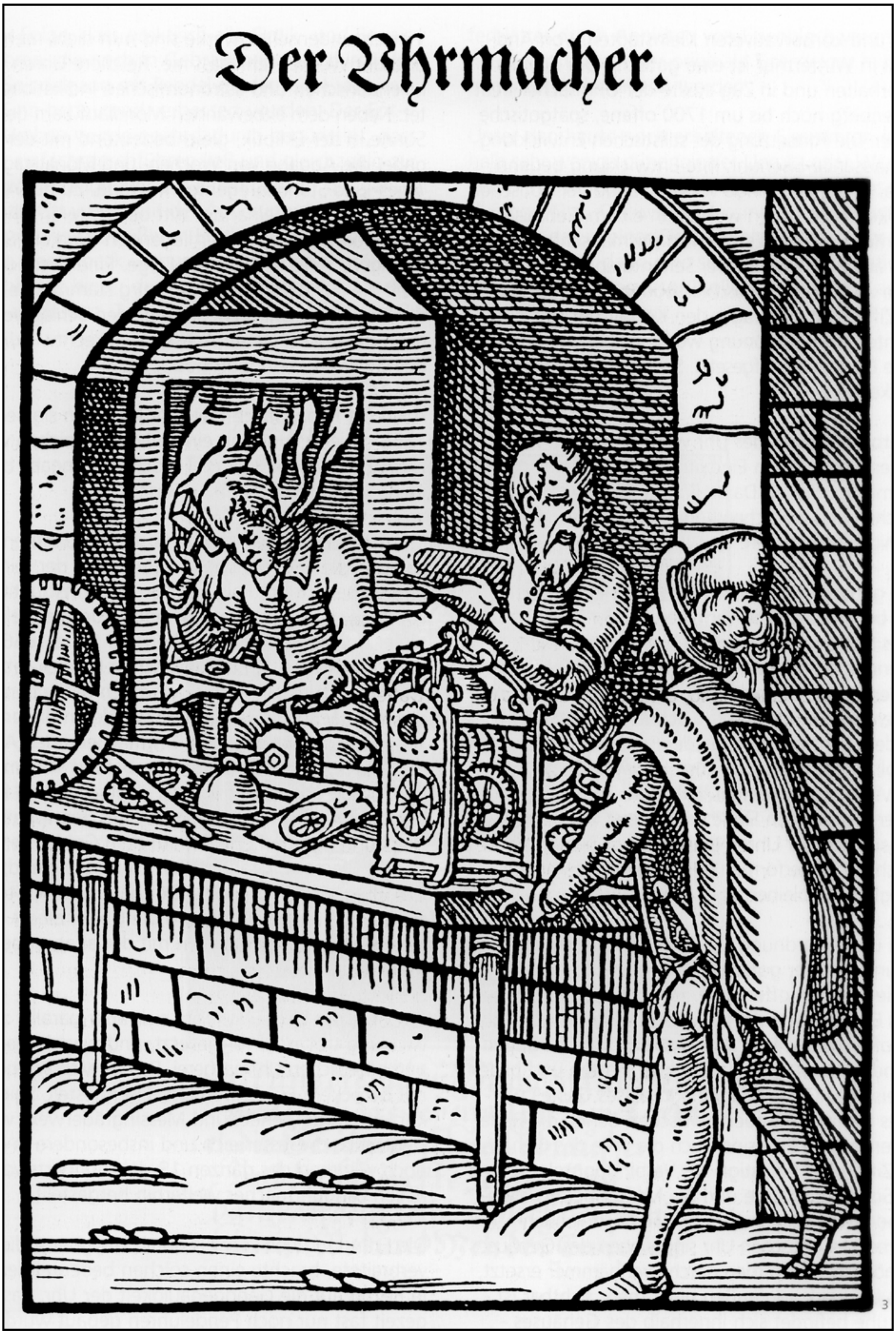

Figure 1. Jost Amman's woodcut of a German clockmaker's workshop in 1568 showing iron Gothic clocks.

search through their back copies to see what he had to say.

I have recently had the need to re-examine both illustrations quite closely and it turns out that there is still much to be learned from them. So, instead of thinking 'Oh no, I have seen these countless times before', I hope readers will bear with me and discover what a great deal of information they reveal.

The illustration in **figure 1** shows Der Uhrmacher (The Clockmaker) and was included in *Das Ständebuch* (*The Book of Trades*) by Hans Sachs, first published in Frankfurt am Main in 1568. This book has woodcuts by the artist Jost Amman (1539-91), who was born in Zurich and died in Nuremberg. Not only is he famous for his illustrations of trades shown in this book, but he also produced some of the earliest illustrations for decks of playing cards.

The Book of Trades illustrates numerous crafts, arts and trades carried out in Nuremberg in the sixteenth century. While many of these trades, such as the brewer, barber, coppersmith, founder, astronomer, armourer and designer are recognisable crafts, it is difficult to understand the logic of including pilgrims, money fool, gluttonous fool, jester, natural fool, or the Jew. Each picture is accompanied by a short verse in rhyming couplets, compiled by Hans Sachs (1494-1576), who was a cobbler by trade, but turned to composing poetry and music and he had produced more than 1700 works by the time he died.

However, in the case of The Clockmaker something went seriously awry and the accompanying verse is concerned solely with sandglasses (also known as hourglasses), not mechanical clocks. Perhaps it had been intended that an illustration of a sandglass maker, which was an established trade in Nuremberg at this period, was to be included, but for some reason it never appeared, despite a verse having been written for it. The publisher or printer just used the most appropriate one to accompany The Clockmaker, even though it does not have much in common with the illustration. It is particularly unfortunate that the only illustration with an inappropriate description is the one that horologists are most interested in.

Those who would like to look at all the illustrations and verses, printed facsimile copies with additional illustrations and text are available at a modest cost, while the Victoria & Albert Museum has included some pages on its website, complete with a commentary and translations of the verses. Just search for 'Hans Sachs Book of Trades' or go to http://www.vam.ac.uk/content/articles/t/the-book-of-trades-das-standebuch/.

The illustration depicts a small open-fronted workshop that looks out directly on to the street and is occupied by the clockmaker, who is engaging with a customer, with an apprentice or assistant working in the centre. The building is a substantial structure constructed of blocks of stone with the large opening supported by a stone arch. This open front would give plenty of light in the summer, but in the short dark days of winter the opening would be closed by wooden shutters to keep out the bitter cold weather and the work would have to be undertaken using the light from candles, which would not be conducive to working on the finer details of clocks. The workflow might have been organised so that forging red-hot iron, which requires low light levels to judge the temperature of the metal, was done in the winter months, while work that needed good illumination was carried out in the summer when full advantage could be made of natural light. The other advantage of doing as much of the smithing in the winter was that the forge would keep the workshop warm, whereas in the summer the heat would be overpowering in such a small space.

A workbench, supported on two legs, projects out into the street to double-up as a display area for passers by. Charles Aked stated that it was a requirement that in Germany and especially France, craftsmen such as clockmakers were required to work in full public view to ensure that they did not infringe on the trades of other guilds.

This is not strictly correct. The 1544 statute of the Paris Guild of Clockmakers stated that: 'The said masters may not exercise the said trade, if they do not maintain a shop and work openly by way of guarantee on a public street'. This was to protect the customers, not members of other guilds, so that watchmakers and others using precious metals did not work in seclusion on the upper floors and did not cut corners.

On display are the types of clocks and various components made in the workshop. Most prominent is an iron Gothic clock with its tall rectangular frame, bell and bell frame clearly visible. The two trains of wheels, one in front of the other are similar to those used later for English lantern and 30-hour clocks. Each train appears to have just two wheels and while it was quite common for the striking train to have just two wheels, this feature on the going train was usually restricted to only the very earliest clocks, and three-wheel going trains were usual by this period.

Above the bell and protruding through the bell frame is a foliot with curved arms without regulating weights. In reality it could not possibly work like this and it should have been positioned between the bell and the top of the frame so it could swing without hindrance. It appears that the artist did not make detailed sketches or take notes of this detail and relied on his memory, which proved to be unreliable.

In any event a foliot was rarely used on clocks of this type, though there are exceptions, and a two-spoked circular iron balance was usual. Nowadays we are used to seeing Gothic clocks, either in museums or illustrated in books, that have a foliot rather than a balance. But these are almost invariable incorrect restorations, often done because not only is a foliot much easier to make than a balance, it looks more 'olde worlde'. Gothic clocks with their original oscillator are very rare and those that survive usually have a balance, not a foliot. **Figure 2** shows a Gothic clock of the type in the woodcut.

Amman shows the dial in some detail and it is typical of those made in Germany, Switzerland and Austria, being the same width as the frame, extending down almost to the bottom of the feet and with a shaped top. These Germanic clocks are different to French and Flemish examples, whose dials are shorter at the bottom and sit beneath a top plate instead of an open top frame, **figure 3**. Sometimes early French and Flemish clocks have the wheels at right angles to the dial, which seems an unnecessarily complex arrangement.

The dial would be made of painted iron — two centuries before Osborne & Wilson 'invented' the painted clock dial in Birmingham — without a separate chapter ring. The centre has radiating lines in a sunburst design, and while there are usually 12, here a few less are depicted. Often the centre of the dial is cut out to reveal the hour wheel (also known as the dial wheel). This wheel would be made from iron sheet, rather than the separate iron rims and crossings used on the train wheels. A peg inserted through one of 12 holes would trip off a simple alarm, which could only be set to hourly increments, This wheel would be painted with a sunburst pattern and it is this that we are probably seeing, though the resolution of the woodcut cannot depict this amount of detail.

At the top is a moon display showing equal light and dark phases. Moon indication was common on Germanic clocks, but much less usual on French Gothic clocks. Overall, apart from the incorrect foliot, Amman shows a fairly accurate representation of a Gothic clock of the type made in Nuremberg in the sixteenth century.

A few other clock parts lie scattered on the bench. These include another dial, this one being rather simpler without a moon phase and probably without an aperture to access the dial wheel to set an alarm. There is also a wheel of a size suitable for a greatwheel and a bell. The attention to detail is such that even the lug on the top of the bell is shown. This type of bell was widely used on European clocks but is only found on the very earliest English lantern clocks.

On the left is a very large wheel propped up against the wall and a straight foliot, both of a size more suited to a turret clock than a domestic timekeeper. Partly hidden behind the customer's arm is a wheel that is too large for a domestic clock and is more likely to be one of the smaller wheels of a turret clock. The clockmaker is holding in his left hand what appears to be the case of a small clock, though none of the other components on the bench would be suitable for it.

The other item, attached to the bench rather than just sitting on it, is a vice immediately below the clockmaker's right hand. It appears to be a leg-vice rather than the modern type of engineer's vice with sliding jaws. As its name implies a leg-vice consists of two long legs hinged at the bottom, with jaws at the top for gripping a piece of metal. Pressure is applied by a screw, as with an engineer's vice, while a leaf spring between the legs facilitates opening the jaws. The fixed leg would be attached firmly to one of the bench's very substantial timber legs. This type of vice is still preferred by blacksmiths.

In the far corner at the back of the workshop is a blazing blacksmith's hearth. This is where Jost Amman has used some artistic licence as it is not actually in use and the apprentice is working on a piece of cold metal, as will be discussed shortly. If the actual scene had been depicted with the fire just 'ticking over' or even completely out, the purpose of such a large structure that dominates the workshop would be very unclear.

In practice the apprentice would be pumping a pair of bellows by means of a wooden handle, probably on the left and hidden from view behind the left-hand wall of the front arch. Once the iron was red-hot the clockmaker would remove the metal from the fire using tongs and hammer it to shape on an anvil.

A small simple woodcut like this cannot show even a few of the other tools necessary for making clocks. There would be racks of files, hammers, tongs and other smithing tools, as well as a drill and a simple lathe for turning and polishing pivots. Gothic clocks are held together by wedges and taper pins, not screws, so there would be no taps, dies or other means of making threads.

These clocks are a tribute to the great smithing skills of the clockmaker and the 11 separate parts that make up the frame are held together with dovetail joints locked together by just two taper pins. In contrast London's clockmakers eagerly adopted screws, which had only recently come into more widespread use, and lantern clocks include 17 screws.

Figure 2. Germanic Gothic clock by Erhard Liechti, Winterthur, Switzerland, 1584. Note the holes in the dial wheel for a peg to let off the alarm. The dial is new; the flowers on the bell frame and possibly the balance are restorations. (Deutsches Uhrenmuseum, Furtwangen.)

Very often a third hand is needed when forging iron and the apprentice would assist by holding various tools, such as chisels, punches, drifts, fullers, bolsters and swages between the work and the hammer wielded by the clockmaker himself. The work would need re-heating many times before it was in its final shape and it may have needed fire-welding which requires it to be at white-heat, but if it is too hot it will burn and the piece will be ruined. There had to be complete co-ordination between the master and his assistant, each one relying on the other, specially when working with red-hot iron as loss of concentration could lead to accidents and injury. This is how the apprentice learned the skills necessary to make iron clocks.

It is worth pointing out that once a smith has a hammer in his hand and has got into the rhythm of forging iron he is reluctant to swap to another tool such as a drill, saw, lathe or file. Wherever possible iron was cut with a chisel, holes punched into hot iron and shaping done with a hammer.

Of course on a clock small holes had to be drilled, gear teeth shaped and parts fitted together by filing. Smithing skills, greater than possessed by the average village blacksmith accustomed to shoeing horses and making hinges and the like, were needed to make Gothic clocks. It is hardly surprising that English clockmakers abandoned iron for wheels and frames in preference to brass for the new lantern clocks that were introduced about 1600.

In the centre of the workshop the apprentice is hammering a rectangular iron dial. Since he is holding it in his left hand it cannot be hot, hence the incongruity of the blazing hearth behind him. Also, he cannot be forging the sheet to reduce its thickness since the anvil he is using is far too small. Close inspection reveals that it is actually fitted into the hardy hole of a large anvil, which is mostly hidden from view behind the bench. The tall stem of the small anvil is held with a wedge that is curved so that it is easy to remove when another stake is needed. This attention to detail shows that Jost Amman must have based his observations on an actual clockmaker's workshop.

While the piece of metal being hammered by the apprentice, like the dial lying on the bench, appears to be relatively thick, this is probably due to the inability of a woodcut to show the actual thickness of a thin sheet of iron. The dial has a circular aperture for access to the dial wheel for setting the alarm, as already described. There would be no need for the clockmaker to reduce the thickness of the dial as he would buy from the iron merchants round and square bars of various sizes which would be forged into the frames, wheels, arbors, balance, verge and the various levers of the strikework, while iron sheet would be supplied in a thickness suitable for clock dials. The ironworks would have had water-powered trip hammers and rolling mills for producing the iron bars and sheets in convenient sizes.

The clockmaker would cut the sheet to size and chop out the aperture with a cold chisel; the one thing he would **not** have used is a piercing saw. The rough edges would then be filed to the finished shape and size, the final task being to remove the distortion caused by the chisel. Or perhaps it was done in two stages: filing roughly to shape, then flattening, followed by filing to the finished size. This is what the apprentice is doing: making sure that the dial is flat before it is sent to be painted, not hammering it to reduce its thickness.

A detailed examination of this small woodcut has shown it to be remarkably accurate, with a great deal of information. We can forgive Jost Amman for his misinterpretation of the foliot and his artistic licence with the blazing fire, for so much can be gleaned from his illustration. Since a similar attention to detail can be found in the numerous other woodcuts, it is not surprising that The *Book of Trades* has long been regarded as an important source of information on the working practices of craftsmen and others in sixteenth-century Germany.

In the next part the equally well-known copperplate engraving by Johannes Stradanus is similarly scrutinised to see what has been overlooked previously.

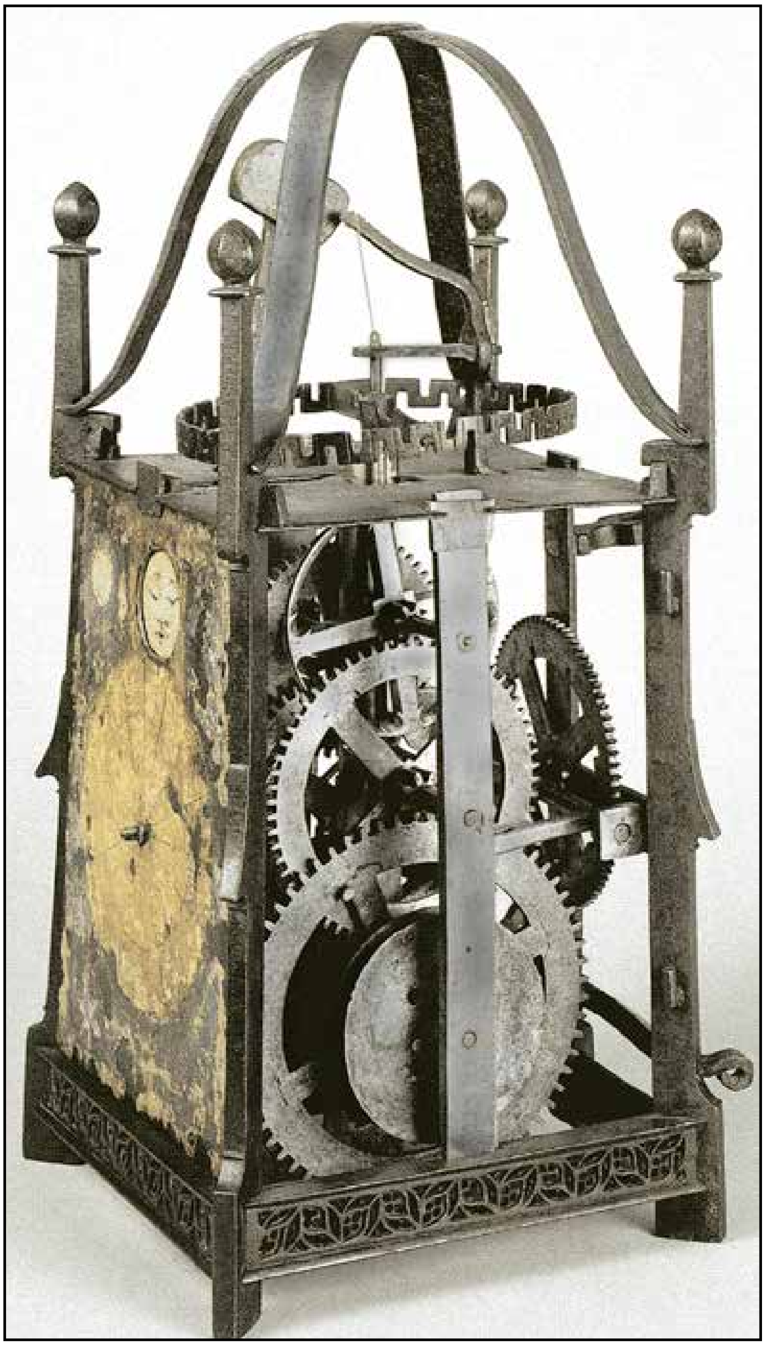

Figure 3. French or Flemish Gothic clock with a top plate, transverse trains, an original balance and verge escapement, possibly pre-1500. Only the hand and bell are missing. (Mainfränkisches Museum Würzburg.)