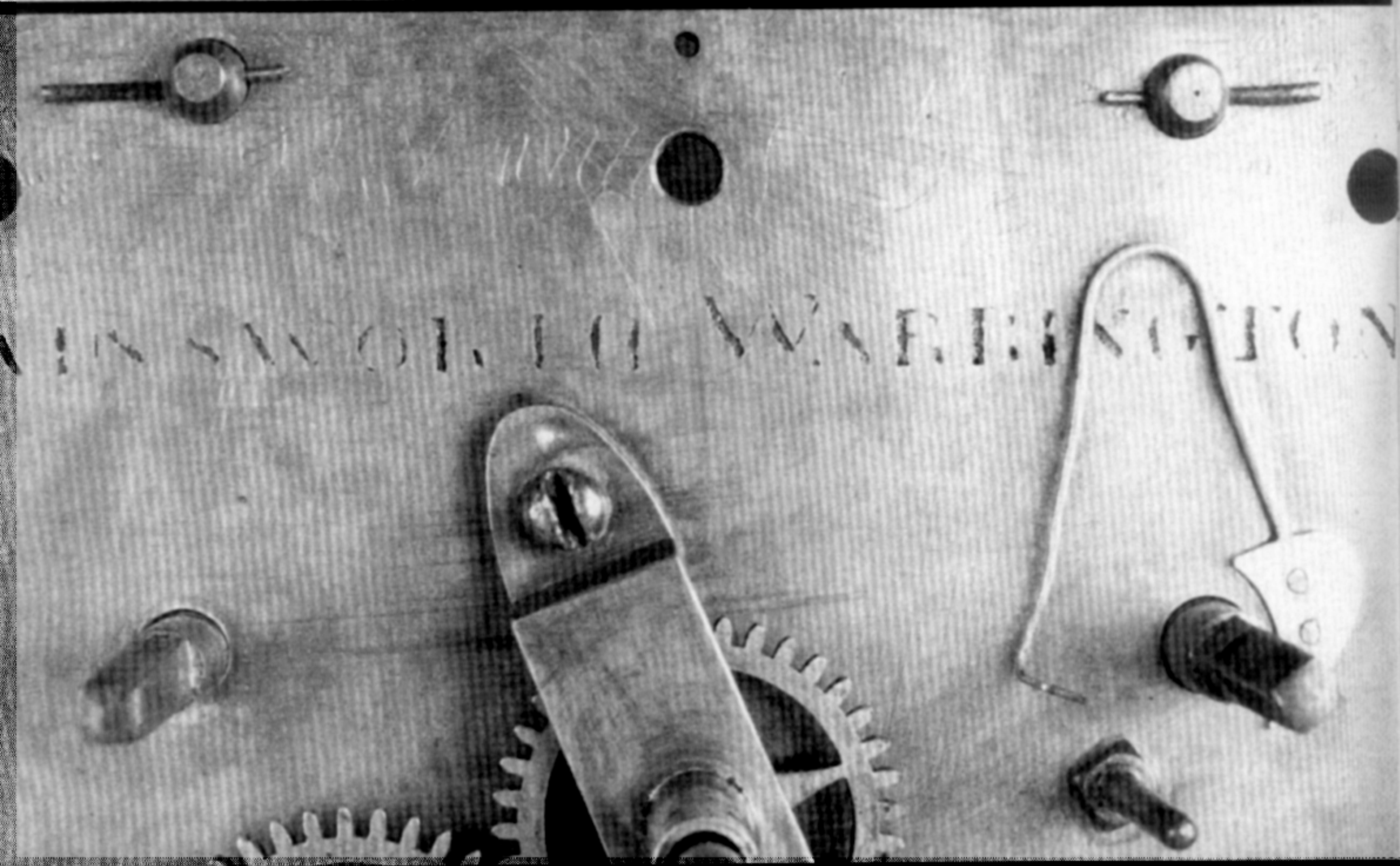
Figure 1: Ainsworth's name cast into the lower part of the front plate of a 19th century factory-made eight-day movement.



Marking time

What was the purpose of the scribed 'marking-out' circles often found on the front surface of the front plate of longcase clock movements?

John Robey

Anyone who has worked with British clocks soon recognises the scribed circles that can often be seen on the front plates of longcase and bracket clock movements. It is often said that these show that the clock was hand-made to an individual specification and not mass-produced.

While this may appear obvious it is not, as we shall see, as straightforward as that. But the

Figure 2: The front-plate of an anonymous eight-day longcase movement, c1680-90, showing the scribed lines.

converse is not necessarily true either as a hand-made high quality clock will most probably have had all trace of these marks filed, scraped and polished away. If these scribed circles are studied carefully they can in fact tell us quite a lot about how the clock was made - the results are not quite what you might at first expect and some widely held myths are subsequently dispelled.

A clockmaker producing a run-of-the-mill clock, particularly an ordinary 30-hour or eight-day clock where price was all-important, would smooth and polish the rear and inside surfaces of the plates - but not all of the front surface. As the distance between the plates had to be equal all over and the shoulders of the arbors would rub on the inside surfaces smoothing the plates was good horological practice. The outside of the front plate, which could not be seen when the dial was in place, was often left with the casting and planishing marks, as well as any scribed lines, with only minimal cleaning up.

An example of such a clock is shown on the front cover. This has a factory-made movement by George Ainsworth who had a pinion factory and brass foundry at Warrington from about 1803 to 1815 when he died. While bells with Ainsworth's name cast on them have been noted, I have not seen any other identifiable examples of his movements recorded in the horological literature.

As can be seen 'Ainsworth Warrington' is cast into the front plate and it is clearly a well-made movement, though of standard design. All the striking levers, for instance, are very neatly and elegantly made. They look as if they have been machined, but it is more likely that they would have been made by filing.

There are no marking-out lines scribed on the plates, so the pivots may have been located by a 'master plate' or a jig. The name on the front plate, **figure 1** has been cast in, not punched or engraved, and the plates may well have been rolled after casting and then filed smooth.

Incidentally, examination of some quality 20th century movements will reveal a pivot hole that does not seem to be necessary - the corresponding hole on the other plate ➳

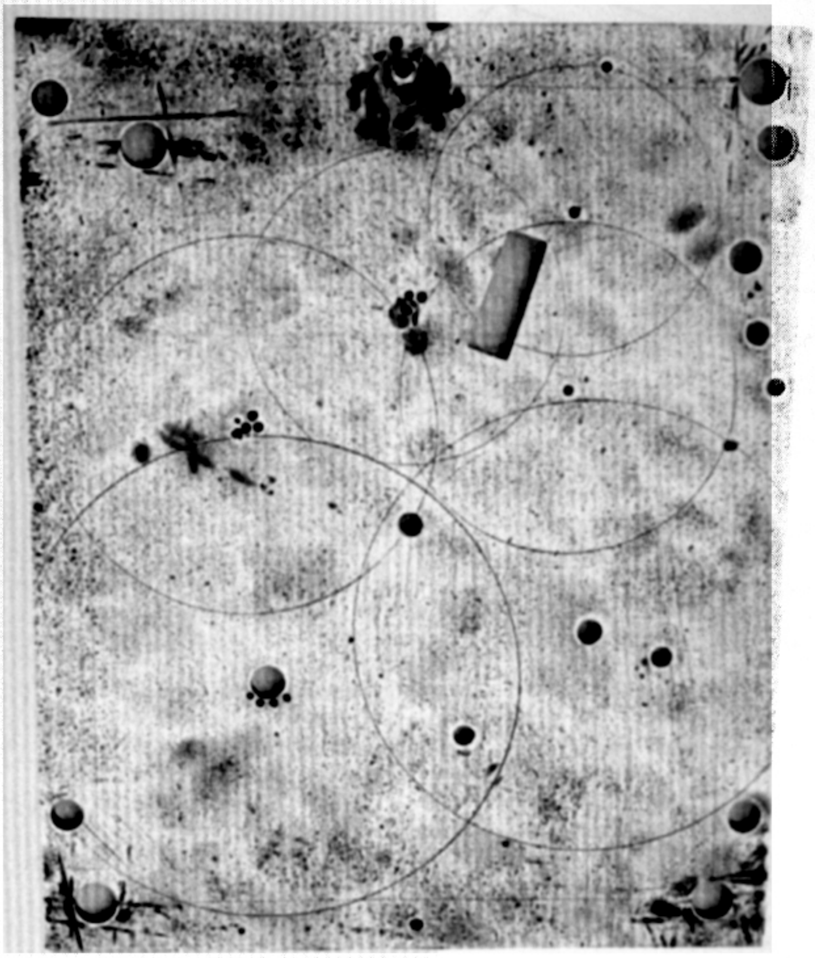


Figure 3: The front plate of a mid 18th century 30-hour clock by Richard Scholfield of Rochdale, showing the scribed lines.

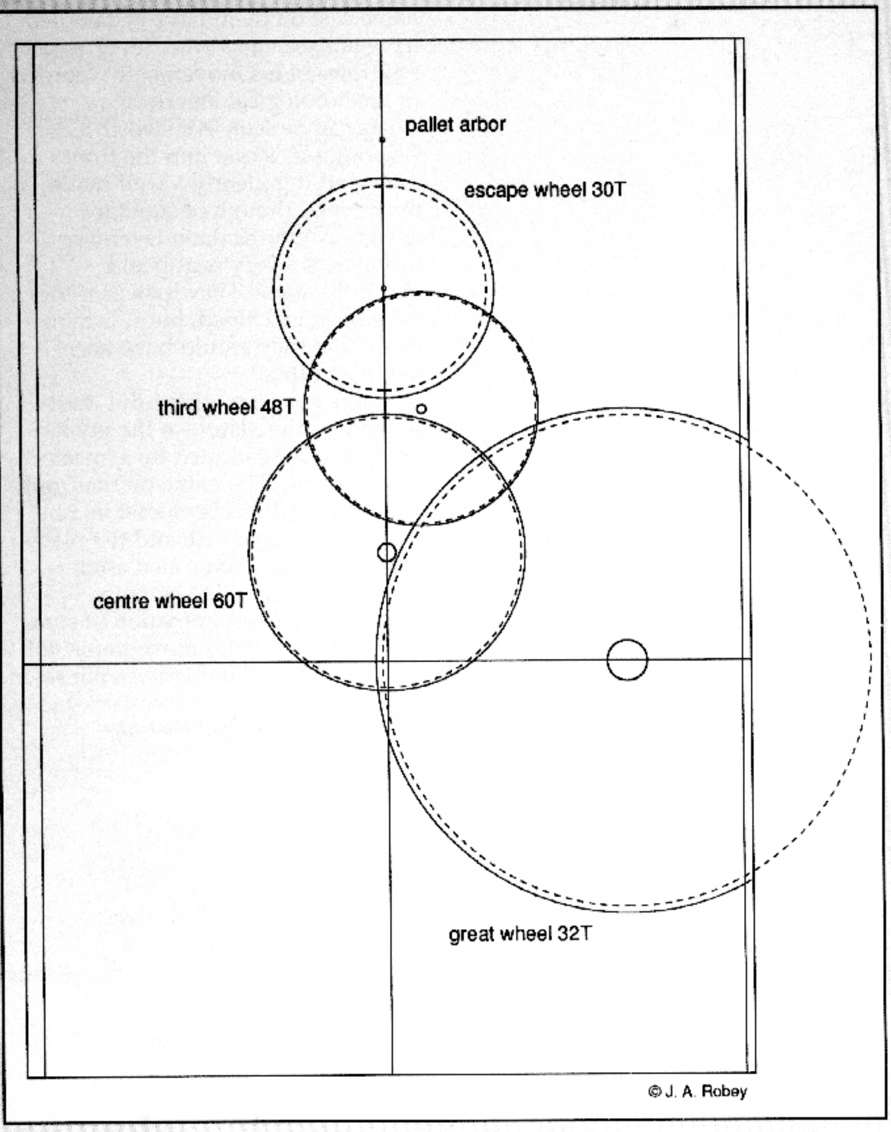


Figure 4: Scribed lines of the anonymous eight-day going train.

accommodates an arbor with a cock, for instance. It was often simpler for all the holes in both front and rear plates to be drilled from a master jig, even though they were only needed in one of the plates. This has been seen on a 1920s ship's clock, for example.

A development from the use of templates to mark out clock plates was to punch the hole positions using a fly press. A substantial iron plate with the required number of sharp punches, all in the correct position, spotted all the pivots with one swing of the fly press lever. It was then a simple matter to drill through the punch marks. This was the method used by one of the last clockmakers to manufacture traditional English clocks on a commercial basis.

The scribed circles also illustrate the way that the movement was marked out - and it is soon apparent that this is not the way that is often assumed and not the way that is recommended nowadays for amateur clockmakers. Anyone starting to make a clock soon finds that after the essential lathe and a means of cutting the gear teeth (probably using the lathe initially), a means of 'depthing' the teeth - to get the correct amount of engagement for free running with minimum friction -is recommended.

After recovering from the shock at finding the price of a traditional type of clockmaker's depthing tool, the budding clockmaker finds that the traditional method of mounting the wheels on their arbors and making the pinions from solid can be modified. The pinions are made separately from their arbors and can then be meshed with the wheels using a simple depthing device before being mounted on their respective arbors. Once the correct tooth depth is found, the depthing tool (either the traditional or simple version) is used to scribe the arbor-to-arbor distances and so establish the pivot positions.

This is excellent recommended practice, and anyone making a clock for the first time should follow the advice, but the working methods of makers of precision clocks such as regulators were not necessarily those of the clockmaker turning out run-of-the-mill longcase clocks.

In order to investigate how the clock plates were marked out, not only have as many clocks as possible been examined, but two typical longcase movements have been studied in more detail and the wheels, pinions and scribed lines carefully measured. The measurements are in fractions of an inch, as this was probably the method originally used. The results are summarised in the table.

The first movement is an eight-day clock with its countwheel on the main arbor outside the rear plate, and having a 10in square dial. It once had bolt-and-shutter maintaining power, and although unsigned it is most probably of London origin from about 1680 to 1690, **figure 2**. The second movement is a mid 18th century plated 30-hour by Richard Scholfield of Halifax, **figure 3**, the 12in square dial having a wavy 'Dutch' minute band.

The outside diameter of wheels, and the scribed circles, as well as any other scribed lines, have been drawn to scale. To make it appear clearer, the going and striking trains are drawn separately, **figures 4** to **7**. Solid lines represent scribed circles, pivot holes and other marks, the outside diameters of the actual wheels being represented by dashed lines. The first thing to notice is that none of the scribed circles pass through the pivot holes of the next arbor, as they would if a depthing tool had been used. No circles have been scribed for the pinions.

For the average clockmaker a depthing tool would have been a great, and probably unnecessary,

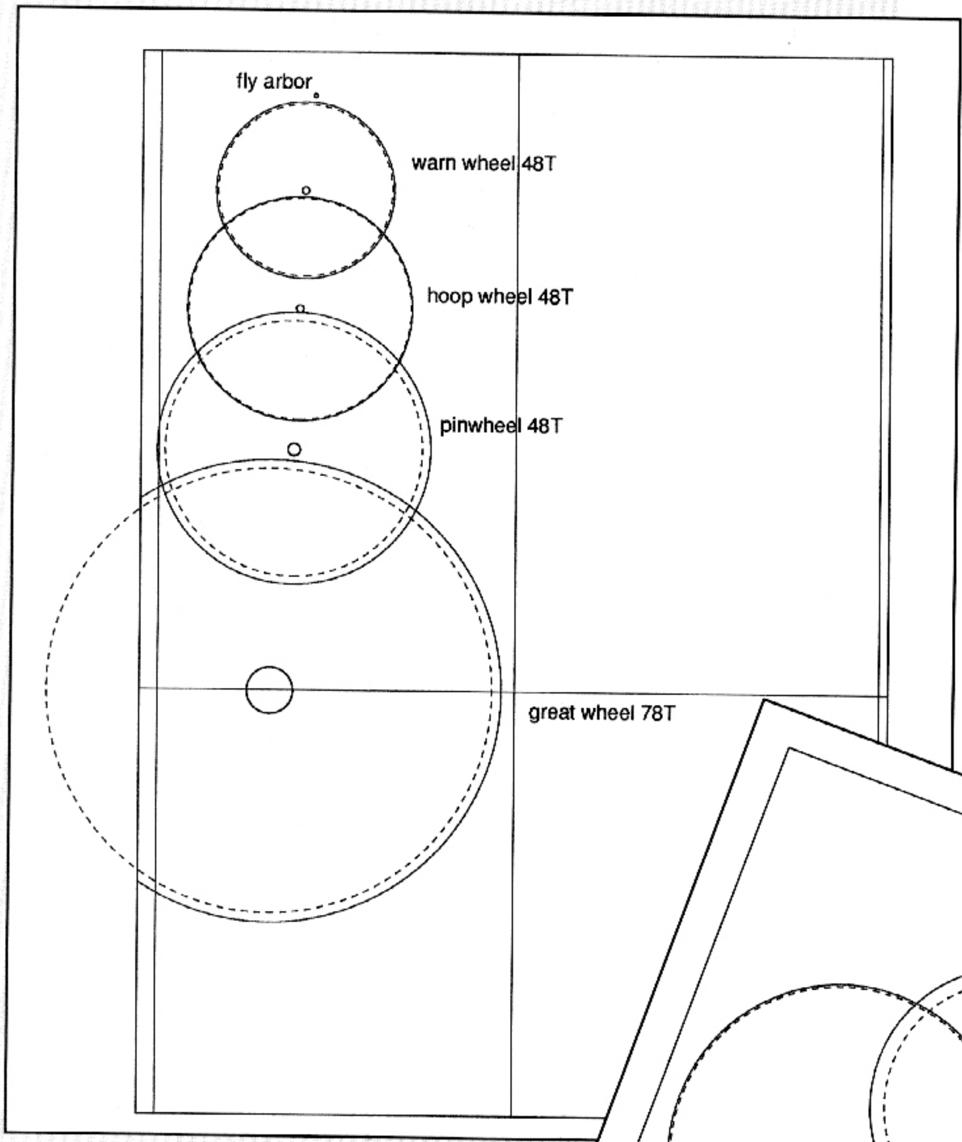


Figure 5: Scribed lines of the anonymous eight-day striking train.

expense, as his experience would have told him how much depthing the wheels and pinions needed. In any event, the average longcase is not particularly critical in many of its constructional aspects, and one must always realise that what is recommended, or even essential, for a regulator is not always needed for a standard house clock. Abraham Rees in his *Cyclopaedia* of 1819-20 (the horology articles were reprinted as *Rees's Clocks, Watches and Chronometers* in 1970) states that 'this method (using a depthing tool) is very little known in England, and still less used, though it conduces greatly to perfect action'.

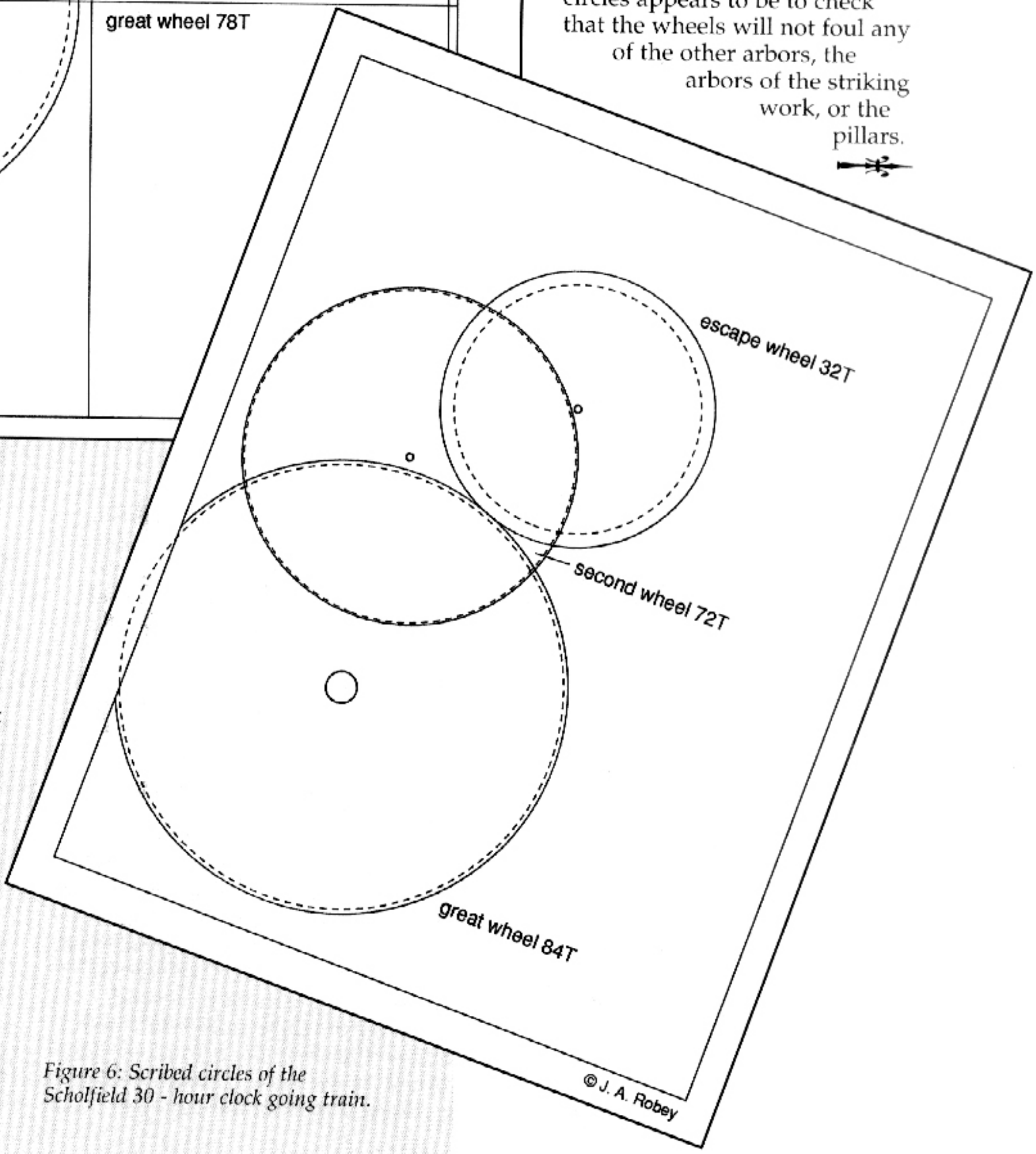


Figure 6: Scribed circles of the Scholfield 30 - hour clock going train.

The second point to note is that the diameters of the scribed circles do not correspond with either the outside diameters of the wheels or their pitch-circle diameters. The scribed circles are always larger than the wheels, and in fact do not seem to correspond to any significant dimension. Nor are they larger than the wheel diameters in any systematic way.

What can be deduced from all this? It confirms that the circles were not used to mark out the positions of the arbors, nor to achieve correct depthing. In fact, for depthing only short arcs would have been sufficient, whereas in practice complete circles are invarably found - and they are usually scribed much deeper than really necessary.

The only other reason for the circles appears to be to check that the wheels will not foul any of the other arbors, the arbors of the striking work, or the pillars.

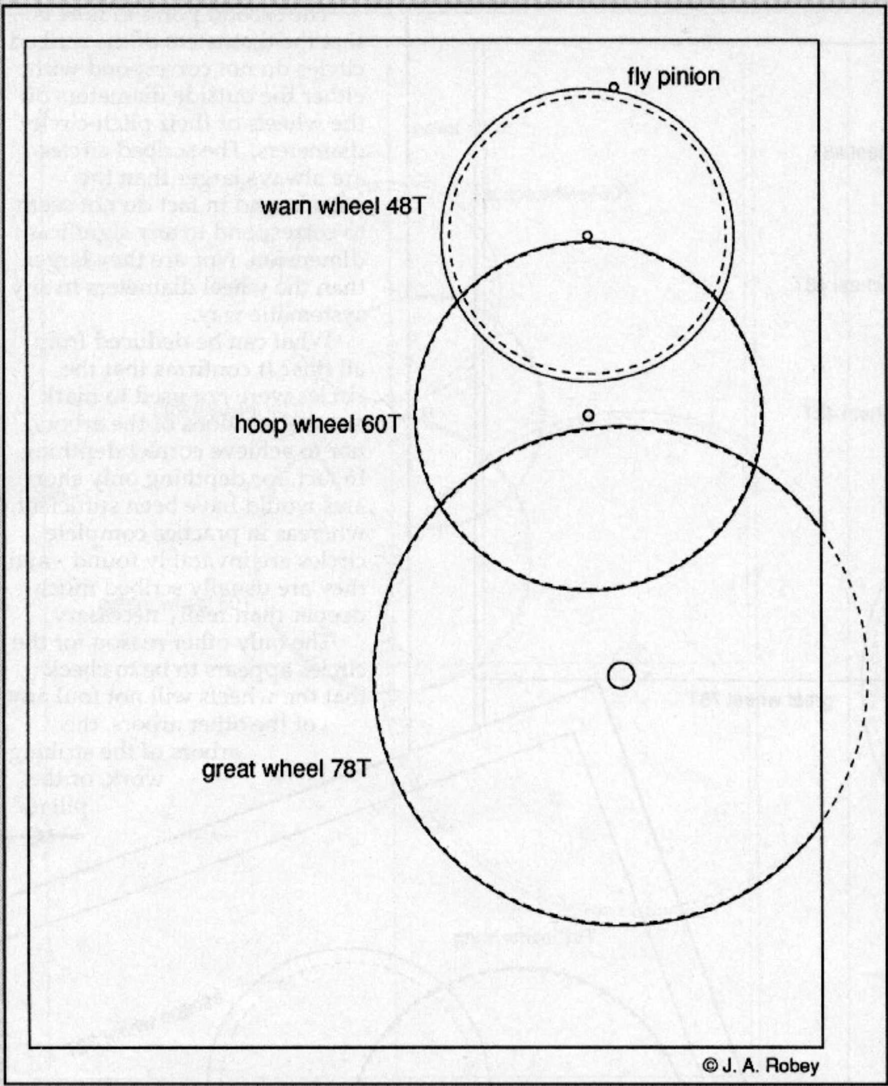


Figure 7: Scribed circles of the Scholfield 30-hour clock striking train.

It would appear that the clockmaker simply set his dividers against each wheel, so that they were just larger than the wheel radius, but not by any specific amount. This would explain why the differences in diameter between the wheels and the circles appears to be quite random.

Most clockmakers, by and large, would make a limited range of movements and once a clock had been 'designed' the same layout would be used for other similar clocks. Rees recommended that the wheel trains should be laid out on 'pasteboard', and then the arbor positions transferred to the plates by pricking through. If this was done then it would explain why there appears to be no lines to indicate the pivot positions on the plates themselves.

But surely there would be no need for any scribed lines on the plates, particularly if a number of similar movements was being made. The eight-day movement has a vertical line through the pallet, escape and centre arbors as well as a horizontal line through the winding arbors, so some marking out on the plates was done in this case.

It may well be that although each clockmaker had a small number of standard designs for his wheel trains, which he pricked through with his pasteboard 'jig', the location of the pillars and striking work arbors was on a more individual basis, and this was why the full circles were scribed. It would be an interesting exercise to measure up the trains of several clocks by the same maker, but with different arrangements to the striking arbors, to see if the same train layouts were used, ie from the same jig.

Sometimes it is clear that the position of the wheels has had to be changed during construction of the clock. It may have been that although the clockmaker's standard wheel layout was used, he may for some particular reason have had to put the pillars in some other position, and the check with the scribed circles showed that the modifications were necessary.

Although pricking through would not have been as good as using a depthing tool, for most longcase clocks it would have been quite adequate, particularly as the clockmaker would round up the wheel teeth with a file to ease the fit with the pinion if necessary.

A further point to consider is that if each of the thousands of clockmakers throughout Britain had used a depthing tool where are the depthing tools now? Even taking into account the fact that they would have been passed down from father to son, we should be knee-deep in them in antique shops and at clock fairs. In practice, apart from the very small examples used for watchmaking, they are seen only very rarely (and the same also applies to wheel-cutting engines).

Another feature to note is that apart from a couple of instances the wheel diameters are anything but simple fractions of an inch - often a very awkward number of sixty-fourths - whereas the centre-to-centre distances, measured to the next arbor with its meshing pinion up the train, are usually quite simple measurements - though there is the occasional thirty-second of an inch.

Does this mean that when the clockmaker cut his wheels or ordered them for specialist wheel cutters he would specify the centre-to-centre distances rather than the outside diameters as is done today? It would be interesting to know how the 18th century clockmaker actually did specify his wheels. The answer will probably have to be sought in any surviving notes of a clockmaker or other documentary sources.

We must always remember that not only were the constructional methods used in times gone by often different from those used today - the materials used were also different. Brass components were always made from castings, usually quite close to the original size, so that as little material as possible was wasted during turning on the lathe or filing.

	outside diameter	scribed circle diameter	centre-centre distance
Anonymous 8-day, c1690			
Going Train			
great wheel	$3\frac{13}{32}$	$3\frac{1}{2}$	$1\frac{13}{16}$
centre wheel	$1\frac{7}{8}$	$1\frac{59}{64}$	1
third wheel	$1\frac{19}{32}$	$1\frac{5}{8}$	$\frac{7}{8}$
escape wheel	$1\frac{27}{64}$	$1\frac{17}{32}$	$1\frac{1}{32}$
Striking Train			
great wheel	3	$3\frac{1}{8}$	$1\frac{5}{8}$
pin wheel	$1\frac{47}{64}$	$1\frac{27}{32}$	$\frac{15}{16}$
hoop wheel	$1\frac{1}{2}$	$1\frac{33}{64}$	$\frac{13}{16}$
warn wheel	$1\frac{11}{64}$	$1\frac{13}{64}$	$\frac{25}{32}$
Scholfield 30-hour			
Going Train			
great wheel	$3\frac{5}{64}$	$3\frac{9}{64}$	$1\frac{5}{8}$
second wheel	$2\frac{19}{64}$	$2\frac{21}{64}$	$1\frac{3}{16}$
escape wheel	$1\frac{23}{64}$	$1\frac{59}{64}$	$1\frac{7}{16}$
Striking Train			
great wheel	$2\frac{59}{64}$	$2\frac{15}{16}$	$1\frac{17}{32}$
hoop wheel	$2\frac{1}{64}$	$2\frac{3}{64}$	$1\frac{1}{16}$
warn wheel	$1\frac{41}{64}$	$1\frac{47}{64}$	$\frac{7}{8}$

Table: Summary of the wheel diameters, scribed circles diameters and centre-centre distances.

For instance wheel collets were cast several together on a stick - not turned from cylindrical bar.

Wheels themselves were cast complete with their crossings so that after cutting the teeth the crossings just needed cleaning up with a file - no time-consuming marking out, piercing and filing to shape. It may surprise today's clockmakers that even the thin springy lifting piece which nowadays is cut from half-hard sheet brass started life as a brass casting which was hammered to harden it and then filed to reduce its thickness. Likewise iron and steel components were made from quite accurate forgings, again needing just filing to finish them off, obviating the need to have templates to mark out components such as rack hooks or locking and warning levers from sheet material.

Large pinions, which could not be made from pinion wire, started off as a forged arbor with a larger diameter portion where the pinion was to be cut. (In any event, in the early days pinion wire was probably not available in sizes suitable for clocks - does anyone know when it was first used for clocks rather than just for watches?)

When you next have a longcase clock to clean take a close look at the plates as they have a tale to tell - as long as you can read the evidence. But bear in mind that there is always the full spectrum from individual hand-made one-off movements to almost mass production and it is very difficult to make generalisations in this, as well as many other aspects of horology.

Like most pieces of research, some questions have been answered, but others have also been raised. Does anyone have any firm evidence as to how 18th century clockmakers marked out and made their movements, especially from surviving notebooks or other documentary sources?

Acknowledgement

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