Worcester Cathedral
Guild of Bellringers

WHEELER'S WOODEN WALLOPERS

The wooden-shafted clapper, designed by Jim Wheeler, and put in Worcester tenor in 2005 was the first of its kind. Like many innovations it set off a chain of development, which has resulted in a greater understanding of the optimum clapper dynamics for large bells. An article about Jim's contribution was long overdue. Hopefully, in highlighting key developments it will correct a number of misconceptions about these clappers and provide an historical record before fact is lost in the whirl of anecdote.

Worcester Cathedral Tenor - 2005

As with big bells elsewhere, the tenor clapper had broken many times over the previous two decades. Jim didn't see why this had to be inevitable, given that most of the rest of the bells were still using their 1928 clappers. So after yet another new one was installed in 2002, Jim welded the broken SG one as an experiment. When another breakage occurred on Christmas Day 2004 this experimental one was pressed into service for a couple of months, with interesting results. Once the replacement slimline Eayre & Smith SG one[1] was in the bell, Jim carried on with his experiment – reasoning that wood was a better material for absorbing stress than (SG) cast iron he replaced the shaft with ash and used the existing ball and counterbalance.

The key features of this clapper are the **wedge section** of the joins and the use of **ball-races** at the pivot. The joins between the wood and the metal are the greatest potential weakness in a composite clapper but Jim's solution worked well, the only issue being the size of bolts used – the M8's used on the early models were replaced

[1] This clapper is kept as a spare and has been used on two occasions since, in 2011 and 2020.

by M10's on later ones. The ball-races make for far more smooth-running than metal in a nylon sleeve and avoid the need for expensive re-bushing at intervals.

Jim made the clapper to mount on the existing staple so that an old clapper could be put back in if failure occurred. He need not have been so concerned - the clapper lasted 5 ½ years and as well as twice weekly ringing had 30[2] peals rung on it, between 13 Aug 2005 and 29 Jan 2011. At the first peal various doubters sat outside waiting for it to break – with no sense of irony one of them later ordered a similar clapper for the tenor at All Saints!.

Not only was it a success in terms of surviving, it had other benefits. The **sound** of the bell was much improved as the clapper bounced off the bell more than the SG one, so allowing a longer period of resonance. The bell was much **easier to chime** and raise correctly, because its centre of gravity was nearer the ball and the ease of swing created by pivoting on ball-races. It was also **easier to ring**, which was probably due to a faster swing time, but I'd don't have figures to prove it, detailed analysis of such aspects being a more recent aspect of Worcester steeplekeeping.

Oddly it did not so much prove that wood was the best material for shafts but that a composite clapper was possible – up till then clappers had been all-metal. It showed that moving the centre of gravity towards the ball of the clapper had a huge effect on performance, and that such change was only possible because the shaft was lighter. There is a misconception that all 'wooden' clappers are lighter than steel ones and of course many of them are, but this clapper in total weighed pretty much the same as the steel one it replaced (32kg vs 33kg) – however the location of the weight is rather different. Decades ago there had been much debate about the poorer sound of SG metal versus wrought iron without much appreciation that it was clapper design which was the issue not the metal of the ball – in fact the balls for most wooden-shafted clappers now being made are SG iron!

[2] The RW 15 Apr 2011 article says 49 peals which is the total on the bells between installation and breakage. 19 of these were rung on the Harmonic Minor Ten, the C# 8 or the Middle 8, which do not use the tenor.

Tewkesbury Abbey

At the River Severn's next 12-bell floodplain, Malcolm Taylor had tried various experiments to make the tenor a little less sluggish than its 1971 SG clapper allowed. Fred Pembleton had produced a better one, but it was Jim's wooden-shafted clapper that really made the bell sound and handle much better. It was originally a 2-piece, using the 1962 ball and installing the ball-bearing pivot into the wooden shaft. It was installed using the Pembleton staple 11 Mar 2006.

In 2011 Malcolm noticed a crack in the rather heavy ball and had it replaced with a (15%) lighter one. At the same time the top end was altered to the more recent 3-piece style, with the pivot placed within a plate fixed to the shaft *(see Worcester 9th).* A new staple was made and the whole assembly installed 23 Sep 2011.

Left - The original Tewkesbury clapper (2006)

Right - the Worcester 9th clapper (2015) which is the same style as the amended Tewkesbury one.

The key developments are the change in the **pivot fixing** from wood to plate, and the use of the existing staple (left, but not shown) compared to a new design of **staple** (right).

Contrast the old Taylor 1962 ball (left) cut out of a pre-existing clapper and the new Pratt ball (right) made specifically to be fitted in a wooden shaft.

Hallow - Tenor and 7th

This heavy eight (tenor 21-2-17) are quite local to Worcester and like a number of rings never seemed quite as good as they promised. Clappering was the issue and both of the back bells gave Jim the opportunity to try something a bit smaller.

As at Tewkesbury the balls were cut from old clappers, the pivot is set in the wood shaft and the existing staples are used.

Appropriately, Jim rang a peal on this for his 70th birthday in Oct 2006.

Bow Tenor & 11th

Jim's next innovation came on the St. Mary-le-Bow tenor when he created a novel **adjustable independent staple** for his clapper. The tenor clapper was very similar to the Worcester one, having its pivot in the pre-existing counterbalance, whilst the 11th was like those for Tewkesbury and Hallow. These two clappers were on display at Worcester on the occasion of the National Twelve Bell Final on 24 June 2006 but were not installed until 2008.

This (*Worcester 10th*) staple illustrates the design used for the first time at Bow. The staple (on which the clapper swings) is independent of the staple bolt and can be moved across the inside of the bell by use of the adjusting bolts, one of which is visible here.

This is a more practical approach to curing oddstruckness than the alternative of moving the staple bolt inside the headstock by the use of twiddle-pins. It gives more potential adjustment and both ends of the bolts are visible to the steeplekeeper.

Whilst ringers at Bow were, and are, happy with the performance of the 11th clapper the tenor one has been less popular. There is a fundamental problem with all big bell clappers – for full-circle change ringing the clapper needs to have a fast swing time and a low strike time, but for raising the bell so that it goes 'right' (with the striking on the upper lip) it needs to be slow-striking. Wooden shafts have made it possible to design clappers slightly differently from all-metal ones but they are not 'magic wands' and have not made this problem disappear. Jim's Bow clapper rang very well but raising the tenor correctly was difficult.

Another clapper was commissioned, this time from Matthew Higby, with the emphasis on easier chiming, and by 2012 this was in the bell. It did chime well, but made the bell uncomfortably slow when being rung.

So, on the logical basis that the bell spends more time being rung than being raised, the Wheeler clapper was returned in 2018, after he had removed the original counterbalance to reduce the swing time and replaced the reinforcing plates at the wedge joins which made it stronger. The consensus of opinion is that it is the best clapper so far made *for that bell* but the tenor still requires the clapper to be 'turned over' after raising.

Whilst it is not easy to create a clapper for a two-ton bell which will both ring easily and chime easily, the Worcester Tenor one came very close, and the Shrewsbury, Inveraray and Adelaide tenor clappers are all operating very satisfactorily in bells of this size. The problem at Bow is likely to be the clapper 'throw' – how far below the bearings the clapper pivot sits. Mears had a policy of 'tucking-up' big bells to a point where they need a large clapper throw and a large clapper counterbalance in order to work properly. This tenor has ended up, after various changes, with an un-counterbalanced clapper on a long staple and the combination is not optimal. Rather than further alterations of the clapper, a re-design of the clapper-staple combination could prove to be the answer. (Certainly the clapper is significantly shorter than those for the other three bells mentioned.)

Left - the BOW TENOR clapper of 2006, with counterbalance.

Right - the Higby clapper of 2012, with a lighter counterbalance and a much heavier and larger ball

….and the modified Wheeler one of 2018, with counterbalance removed. The strengthening plates at the joins now have 5 M10 bolts rather than 4 M8 ones

2009		2018
	The story at **Dursley** (8:19-2-9) is a now familiar one – the tenor's wrought iron clapper had come to the end of its life, and the SG replacement proved to be a poor substitute. But in this case the tower captain, Frank Byrne, bravely decided to take a risk on the new idea – this was only the seventh one that Jim had made. Installed 22 Apr 2007, it was the same style as the Hallow tenor one, and used the wrought iron ball from the original clapper. Some problems were experienced. The placing of the pivot within the wood relies on the bolts holding the reinforcing plates to be strong enough – on this clapper there were 3 breakages, although that was over a 9-year period, and the solution was to increase their size. The other issue was the development of a hairline crack in the shaft from the wedge point – this was resolved in 2019 by extending the reinforcing plates beyond that point, having glued and bolted the shaft back together. Whilst these were annoying issues for the Dursley ringers they did aid development. This was the last clapper made with the pivot within the wood, the design thereafter placing the bearings on a metal plate. And the reinforcing plates around the bottom wedge were thenceforth longer than the wedge itself. Whilst none of the M8 ball-to-shaft bolts had caused a problem here Jim switched both these and all future ones to M10's.	

Shrewsbury – the next step

The **third innovation** started at St Chad's **Shrewsbury** when the clappers became **'3-piece'** with the pivot and bearings in a metal plate not the wood. Where a counterbalance was required plates could be added to the top end of this plate above the pivot point, though the St Chad's tenor did not require one. Two shafts were ordered for this one – which seemed like a sensible precaution in case of breakage – but overall experience has shown that it is the clapper balls which have failed more often than the shafts. (Wooden-shafted clappers do require more attention than all-metal ones and sometimes do not receive it.)

After that Jim was then somewhat inundated with orders, producing clappers for **Ombersley, Swaffham, Kidderminster, Hereford Cathedral, Worcester All Saints and Redcliffe.**

Of particular interest is the **Redcliffe tenor** because of what followed. The 2008 clapper here used a redundant ball from an old Worcester clapper and at 17kg this was the largest one Jim ever fitted. It should be mentioned that for each clapper Jim never specified the ball size and weight – he took what he was given and designed the rest of the clapper round it in terms of centre of gravity. Experience since then suggests that anything over 15kg for the ball-wedge section is probably overkill.
Philip Pratt had made an extensive investigation into clapper design and prompted by Jim's example, produced one for Bristol Cathedral's tenor which was first pealed 11 Sep 2009. He then made new clappers for the 9th, 10th and 11th at Redcliffe and requested some changes to the tenor one, which Jim did in 2010. In 2014 Philip installed a new clapper in the 8th, so this tower now has five wooden-shafted clappers, more than Worcester!

(left) original REDCLIFFE tenor 2008 and (right) as modified in 2010 with larger counterbalance (7.4kg), new shorter top plate with more, larger bolts. The staple was shortened from 16.8cm to 12.7cm for a shorter clapper throw, and the clapper consequently lengthened below the pivot by 3.5cm.

(above) Tony Bulteel, Jim Wheeler & Philip Pratt

Subsequent to 2010 the counterbalance has been reduced in weight by removing a couple of the plates.

New Balls please

Around 2009 Taylors took up the concept of using the new clappers and were thus **casting ball-and-wedge** bottom ends for their own use and other peoples'. So the **fourth innovation** is the use of these rather than ends of old clappers, which obviously reduces the production workload. Jim first used one of these at **St Neot's** though it had to be replaced just two years later, after breaking – a problem which has occurred elsewhere. It is somewhat ironic that wooden-shafted clappers were invented because metal shafts kept breaking, but now it seems to be the balls! Philip Pratt also started casting ball-wedges for these clappers in 2009 and has now made about 40, with the proud record that none of his have broken.

Jim had 'retired' at this point but kept his hand in with the tenor at local **Hartlebury (2010)** and the tenor at **Guildford Cathedral (2011).**

Repairs, Alterations and Upgrades

Around this time Jim was occupied by re-working the earlier clappers, replacing the secondhand balls at Worcester - Cathedral & All Saints - and at Tewkesbury. A sheared bolt in the clappers at Bow and Worcester had put sufficient excess stress on the shafts to split them. They were repaired and in each case all the bolts replaced by M10's. The only other clapper to suffer this problem was at Dursley, and it is unlikely to be an issue in the future.
At Tewkesbury the top end was altered to the more recent 3-piece style, with the pivot placed within a plate fixed to the shaft. The original staple was replaced and the whole assembly installed 23 Sep 2011. All Saints, Worcester had the same top-and-tail treatment.

Scotland & Wales

Jim's next commission was almost ironic because he was asked to replace a wooden-shafted clapper! The tenor of the fine ten at **Inveraray** had been fitted with a Taylor's clapper in Mar 2010 but the bell would not go up right, a more critical than usual requirement as the bells are usually rung entirely by visitors. The replacement, with a counterbalance to cure this problem, suffered the embarrassing problem of not actually fitting in to the staple. The ball on it was very large, over 22kg.

The Wheeler alternative was installed **Mar 2012** and apart from some 'fine tuning' at the start to decide how many plates to have on the counterbalance it has required no maintenance but is checked every year as part of the annual service of all the bells. It has now done 8 years, longer than previous SG clappers and can be raised 'right' by one person. Concerns that the wooden shaft might suffer in the Scottish weather were allayed by Jim's usual application of many coats of varnish. The clapper ball is only 14kg.

INVERARAY

(left) The 2010 counterbalanced clapper which did not fit in the staple, with its red ball (above), considerably larger than the green SG one it was supposed to replace.

(right) The 2012 Wheeler replacement with adjustable counterbalance and much smaller ball (14kg).

Having made his mark in Scotland, he then did the same in Wales at **Llanbadarn Fawr** (Aberystwyth).

2012 – back to Worcester

The 10th clapper at the Cathedral had suffered a significant number of breakages, the final straw being a last course breakage in a peal attempt on 18 Aug 2012. The new wooden-shafted version was by now Jim's 'standard' design, with independent staple and adjustable counterbalance. A Taylor ball-wedge of 11.8kg was used and the whole thing was installed **autumn 2012**. The ball had to be replaced in 2015.

WORCESTER 10th CLAPPER 2012

Note the various features –

Counterbalance is a series of plates and can be adjusted by adding/removing plates or creating larger ones

Pivot is on ball-bearings

Shaft is ash

Joins at each end secured with 5 bolts and nylex nuts

Ball 11.8kg from Taylor's. Replaced with another Taylor ball Nov 2015.

Staple is sideways-adjustable on a separate staple bolt

Staple bolt is metric thread with locknut to secure

After a commission for **Bewdley** in 2013, Jim returned to Worcester Cathedral to complete the back end in Aug 2015. For these the balls were supplied by Philip Pratt, the **11th** bell having one of **10.5kg** (actually smaller than the 10th), the **9th** one being **8.6kg**. Because of adjustment to the bells' swing times in 2019-20, and for no other reason, both of these clappers were accelerated a little by alteration of the clapper throw. This meant the 9th clapper needed shortening by 1.5cm, which was easy to achieve on-site.

WORCESTER 9th and 11th CLAPPERS 2015

The 11th counterbalance, like that for the 10th (2012) is adjustable by changing the number of plates, a design first used at Redcliffe. The 9th does not require one.
The staple is adjustable on its bolt to adjust for oddstruckness.
The pivot is mounted in metal and on ball-bearings.
The joins of wood and metal each have 5 bolts. The bottom metal plate extends beyond the end of the wedge.
Clapper balls for both from Philip Pratt, 8.6kg and 10.5kg

INTERNATIONAL

The extended visit of Dr Matthew Sorell to Worcester created two links with Adelaide. A Teaching Centre for the Cathedral was created in 2013, copying and improving what had been done at Worcester in 2006-08. Matthew was also so convinced of the merits of our back bell clappers that he asked Jim to make three – for the tenor, 7th and 6th of the heavy eight at **Adelaide Cathedral**.

This was **another innovation** as Jim built these clappers to someone else's specifications, in this case Philip Pratt. All his previous work had been done on what he terms a 'like-for-like' basis – making a better clapper - which has worked very well in most cases. (Even where the staple has been replaced it has not altered the clapper throw, except at Redcliffe in 2010). But some, like Adelaide, require an alteration to the throw, and hence the whole staple-clapper dynamics, which is what Philip did. The result, in the case of Adelaide tenor, is a bell which performs well when up and chimes easily when being raised. Matthew is very happy with the result.

The ADELAIDE clappers for the 6th, tenor and 7th bells. The back two have counterbalances.

Designed by Philip Pratt, built by Jim Wheeler.

The air freight for these cost more than the clappers!

In the interim **Welshpool** tenor was a beneficiary, noteworthy as being the lightest bell (12-0-12 = 615kg) for which Jim has made this sort of clapper.

THE LATEST

This article would not be complete without mentioning Jim's latest work. After the ball failed on Version 2 of the **Worcester tenor's** clapper (23 Dec 2019) it was decided to commission a new one rather than a replacement. **Version 3** has a Philip Pratt ball of **13.5kg** and copies the design Jim had created for the 10th and 11th bells in 2012 & 2015 - the counterweight consists of several separate steel plates rather than a single lump, so that it is adjustable if needed, a feature we made use of almost immediately.

Worcester Tenor Mk2 after the clapper ball broke Dec 2019

Worcester Tenor Mk3 (2020)

It was fitted 23 Feb 2020 and the sound produced was simply amazing – morning Service ringing with an old SG clapper and an afternoon quarter peal with the Wheeler Mk 3 were very contrasting acoustic experiences. The first and so far only peal rung on it was 7 Mar 2020. Because of the Covid-19 restrictions there has been virtually no ringing this year.

The only issue was its natural strike time which even with all six counterbalance plates was a quickish 555ms, some way below ideal. The answer was to alter the staple – the bell still had the original cast iron one which has a long throw but limited space for the clapper counterbalance. Jim made us a new one, fitted 15 Dec, and now the strike time is a better **575ms**. Further planned work is to improve the ease of chiming by adding more counterweight now that there is space to do so.

Conclusion

In 15 years wooden-shafted clappers have transformed the ringing experience for large bells and also smaller ones. Jim's innovative approach to creating a better clapper has led on to improved understanding of clapper dynamics generally. It is something of a compliment to him that many ringers think wooden-shafted clappers are the answer to awkward bells – it isn't true of course, they have to be designed correctly, but their construction makes it possible to solve certain problems which all-metal ones cannot. Like all pioneers he was mocked to begin with, but now 'his' clappers have become something all the bellhangers offer.

Bernard Taylor, Dec 2020

Jim writes -
I would like to thank Bernard for collecting this information together and making it an interesting article. He is as good with a pen as I am with a welding rod and a spanner. It is common sense really – who ever used a sledge hammer with an iron handle?

WHEELER'S WOODEN WALLOPERS

	Made	Altered		Bell	LENGTH Pivot to Strike cm	WEIGHT OF BALL kg
1	2005	2011	**Worcester Cathedral**	Tenor	**102.9**	**13.6**
2	2006	2011	**Tewkesbury**	Tenor	**94.0**	
3	2006	-	**Hallow**	Tenor	**72.4**	
4	2006	-	**Hallow**	7th	**72.4**	**8.2**
5	2006	2012	**Bow**	Tenor	**91.4**	
6	2006	-	**Bow**	11th	**85.1**	
7	2007	2019	**Dursley**	tenor	**80.6**	
8	2007	-	**Shrewsbury S Chad**	tenor	**99.1**	**12.7**
9	2008	-	**Ombersley**	tenor	**78.7**	**9.1**
10	2008	-	**Swaffham**	tenor	**81.3**	**10.0**
11	2008	-	**Kidderminster**	tenor	**92.7**	**10.9**
12	2008	-	**Hereford Cathedral**	tenor	**94.0**	**10.4**
13	2008	2011	**Worcester AS**	tenor	**81.9**	**11.8**
14	2008	2010	**Redcliffe**	tenor	**101.6**	**17.2**
15	2009	-	**St Neots**	tenor	**91.4**	**12.2**
16	2010	-	**Hartlebury**	tenor	**81.9**	**11.8**
17	2011	-	**Guildford Cathedral**	tenor	**86.4**	**14.1**
18	2012	-	**Inveraray**	tenor	**92.7**	**14.1**
19	2012	-	**Llanbadernfawr**	tenor	**80.0**	
20	2012	2015	**Worcester Cathedral**	10th	**90.2**	**12.7**
21	2013	-	**Bewdley**	tenor	**77.5**	**10.0**
22	2015	-	**Worcester Cathedral**	9th	**86.4**	**8.6**
23	2015	-	**Worcester Cathedral**	11th	**96.5**	**10.9**
24	2015	-	**Adelaide Cathedral**	tenor	**101.0**	**15.1**
25	2015	-	**Adelaide Cathedral**	7th	**90.8**	**13.5**
26	2015	-	**Adelaide Cathedral**	6th	**82.2**	**12.0**
27	2016	-	**Welshpool**	tenor	**75**	**10.0**
28	2020	-	**Worcester Cathedral**	tenor	**103**	**13.5**

This is a slightly extended version of the article published in the Ringing World 18 Dec 2020.