Worcester Cathedral
Guild of Bellringers

CLAPPER DATA

Data for measurements (cm) top to bottom – **H** is amount in headstock plus the part sticking out, from flat of staple to top end, **P** the distance between the flat of the staple to the pivot, **S** is the key number from pivot to centre of strike point, that is the shaft, **F** the flight, strike point to end of flight. H + P + S + F = the entire length of staple and clapper assembly.
Also shown is type of the staple bolt thread and fixing and **G** indicates which side of the bell (S for Stay, W for Wheel) the greasing mechanism is – for some of the clappers it is critical which way they are installed.

The front eight bells and the four semitones have wrought iron clappers, the back four of the twelve are wooden-shafted clappers.

Bell	Top	G	H	P	S	F	Notes
1	M16	S			56		Cleaned, re-greased Sep 2018, grease cap replaced New staple bolt Oct 2020 JW
2	M16	S			58		Cleaned, re-greased Sep 2018, grease cap replaced New staple bolt Oct 2020 JW. Flange improved.
3	M16	W			59		Cleaned, re-greased Sep 2018 New greasing assembly Nov 2019 (JCS) New staple bolt Oct 2020 JW. Flange improved.
4	M16	S			62		Cleaned, re-greased Sep 2018 New staple bolt Oct 2020 JW
5	M20				68		Repaired WBF 2016 after breakage. Cleaned, re-greased Sep 2018 Shortened JW Nov 2019, new staple bolt
6	M20				67		Cleaned, re-greased Aug 2018 New staple bolt Mar 2020, set up Oct 2020
7	M20				73		Cleaned, re-greased Sep 2018 New staple bolt Mar 2020, set up Oct 2020
8	M20				81		Broken pin repaired Jul 2018 - Whites Missing Grease mechanism replaced Shortened JW Jan 2020, new staple bolt
2#	M16				58		First clapper Mar 2018 too heavy and loud Second one with smaller ball, July 2018 No lubricating mechanism with this type
5#	M16				63		Cleaned, re-greased Sep 2018 New staple bolt Mar 2020, set up Sep 2020
6b	M20				72		Cleaned, re-greased Sep 2018. Washer put inside staple Shortened JW Mar 2020, new staple bolt
9#	CN				??		Cleaned, re-greased Sep 2018

9	M24		35	16	86	11	Aug **2015**. Staple and clapper. PMP ball – 120mm (4 ¾ “), weight 19lb = 8.6kg. JW shaft 2” x 2 ½” Clapper throw increased Nov 2016 and Jan 2020. Clapper shortened 1.5cm by BHT/ACF Jan 2020
10	M24		38	21	90	13	Created Autumn **2012** after steel clapper broke in last course of a peal attempt 18 Aug. New staple. New clapper w counterbalance. Taylor’s ball 26lb = 11.8kg, measuring 5 ¼” (133mm). Shaft 2” x 2 ½”
							Ball replaced by Nov **2015**. JW says clapper shortened 10mm at that time.
11	M24		44	25	97	12	**Aug 2015**. Staple and clapper. With counterbalance. PMP ball, supplied 22 Jul 2015, 130mm (5 1/8”), about 24lb = 10.9kg, which is lighter than the 10th Shaft 3” x 2 ½”
12	M24				103	12	Version 3, **Feb 2020**. PMP ball 13.5kg new clapper by JW with counterbalance.
							Version 2 - 2011-2019. Taylor Ball 15kg Version 1 - 2005-2011.

All the traditional clappers have now been dismantled, the greasing assembly cleaned and refilled and the clapper re-installed. All screw threads lubricated and new split pins put in. Various missing parts were replaced. **3rd and 7th have wear marks on the clapper pin which might indicate some action is required.**

The old clappers for 9-10-11-12 have all been greased and repainted as ready-to-use spares. We need to organize **spares for 7th and 8th** as they are bells rung in every combination.

The full details of the clappers still need to be measured and noted.

Bernard Taylor
Nov 2020

Worcester Cathedral Bells
CLAPPER DATA - 2

This table shows the changes made to the CLAPPER THROWS in order to reduce clapper swing time and strike time and the associated reduction in CLAPPER LENGTHS, as measured by Pivot Pin to Strike Point (centre of ball). Most of the Clapper Throws were measured by JCS some years ago, the back bells and the changed bells by BHT in 2020.

For reference 5 ½ ” = 13cm, 6” = 15cm. A * indicates planned work

	Throw 2019	Move cm	Throw 2020		Length 2019	Move cm	Length 2020
1	18.7	---	18.7		56	---	56
2	17.5	---	17.5		58	---	58
3	16.8	---	16.8		59	---	59
4	15.2	---	15.2		62	---	62
5	12.7	+ 6.3	19.0		68	- 3.0	65
6	13.0	+ 1.0?	14.0	*	67	---	67
7	11.7	+ 1.3?	13.0	*	73	---	73
8	10.5	+ 5.5	16.0		81	- 3.0	78
9	*11.0*	+ 2.0	13.0		87	- 1.0	86
10	*13.0*	---	13.0		90	---	90
11	*11.0*	+ 2.0	13.0		97	---	97
12	18.4	---	18.4	*	103	---	103
2#		---			58	---	58
5#	12.4	+ 1.0?	13.4	*	63	---	63
6b	10.8	+ 3.2?	14.0	*	72	- 4.0	68
9#	11.4	---	11.4			---	

The Clapper Throws shown in the first column are probably as set up in 1928 except for 9-10-11 which are the throws after installation of wooden-shafted clappers with new staples in 2012 and 2015. (For the tenor each wooden-shafted clapper has been installed on the existing staple). The staples for the 5th, 9th, 11th, 6th and 8th have all been moved recently so overall they are rather less random.

Large changes (2cm+) to clapper throw had to be (partially) matched by changes to the clapper length so that the strike point on the soundbow was unaffected. For smaller changes the clapper was left unaltered as the strike point does not have to be too precise, about +/- ½” or 1cm.

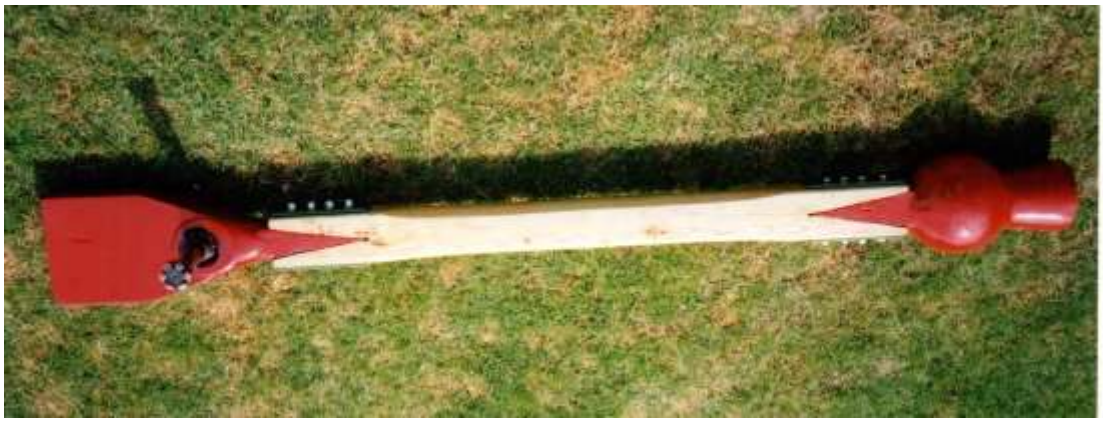
WHEELER'S WOODEN WALLOPERS

The wooden-shafted clapper, designed by Jim Wheeler, and put in Worcester tenor in 2005 was the first of its kind. To avoid the history being lost I have put some key points here.

TENOR CLAPPER

Version 1 – May 2005

The tenor clapper had broken many times over the previous two decades and after another new one was installed in 2002, Jim took the broken SG one and welded it 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 a new 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 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 rebushing at intervals.

Jim made the clapper to mount on the <u>existing staple</u> 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 peals[2] rung on it, from 13 Aug 2005 to 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!.

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

[2] 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.

It was therefore quite a success. Interestingly 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 also 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) mainly because of the large counterbalance – however the location of the weight is rather different. 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!
The strike time of this clapper was measured as **566ms** in 2009.

Version 2 – Mar 2011

In Feb 2011[3] the ball broke and was replaced with a Taylor-supplied one. The original ball-wedge which Jim had cut from a broken clapper weighed 13.6kg. The new one (which was cast as an entity) was rather heavier at 15.4kg. It appears that the weight increase was done to reduce the ball's bounce off the bell after strike, which created more 'hum' than was desirable for the internal acoustic. The strike time of this clapper was **579ms**, measured in 2019.

Insufficient monitoring of the nuts and bolts which hold the joins together led to stress on the shaft creating a split in 2011. Jim was able to glue and bolt the wood back together without further incident. On subsequent clappers these bolts were made a larger size.

On 23 Dec 2019 after nearly 9yrs of impacts (including 54 peals), the 2011 ball sheared across the top where there is a change of section (see picture). Such a clean break suggests a casting flaw or excess stress which other Taylor balls have also suffered.

Version 3 – Feb 2020

After the ball failed on Version 2 on 23 Dec 2019 during a quarter peal attempt it was decided to commission a new one rather than a replacement. It has a Philip Pratt ball

[3] Taylor's raised an invoice 27 Mar 2011 of £102.72 for two clapper balls, one of which would have been for the tenor. The destination of the other one was (probably) the 10th wooden clapper, though it was a year before that materialised.

of **13.5kg** and copies the design Jim had created for our 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.

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 peal rung on it was 7 Mar 2020.

Its natural strike time has turned out to be rather fast, at 545ms. Curiously whilst there was agreement that the SG clapper speed of 545ms made the bell more difficult to ring, there was also agreement that the new clapper made the bell easier, so clearly strike time is not the only issue *in that respect*. This clapper weighs 34kg in total, exactly the same as the first version.

The counterbalance was built up to six plates, weighing 8.2kg - the strike time is now **555ms**. By various metrics it is still too fast so we will either increase the counterbalance or replace the staple with a shorter one.

TENTH CLAPPER

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.

For this one Jim replaced the staple as well as the clapper itself, using his new 2008 design, with the staple independent of, and adjustable against, the staple bolt. The clapper features an adjustable counterbalance, made of plates rather than a single lump, and had a Taylor ball of 11.8kg. It was installed **autumn 2012**.

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

Staple is sideways-adjustable on a separate staple bolt

Staple bolt is metric thread with locknut to secure

After 3 years of use (including 30 peals) a problem arose with the ball and it was replaced by Taylor's about Nov 2015. The peal rung 19 Dec 2015, using the old repaired metal one, was rather fortunate as the next day the old clapper broke in the first touch of Sunday Service ringing, splitting the slider on its way out. Over 40 peals have now been rung on Version 2.

ELEVENTH & NINTH CLAPPERS

For these the balls were supplied by Philip Pratt, the **11th** bell having one of **10.5kg**, which is actually smaller than the 10th. The **9th** has the same design but without the counterbalance. The Philip Pratt ball is **8.6kg**. They were installed **Aug 2015.**

The 9th bell is quite large for its position in the ring and has always been one it is necessary to 'push along'. The new clapper made it easier to ring, but when all the clappering was being adjusted in 2019-20 it was speeded up a bit further, shortening it by 1.5cm, and moving the staple outwards. The composite nature of the clapper made this easy to do on-site. The 11th was speeded up slightly also, but only by packing out the staple, increasing the Clapper Throw.

WORCESTER 9th and 11th CLAPPERS 2015

Features as for 10th clapper. The 11th has a counterbalance, the 9th does not.
Clapper balls for both from Philip Pratt, 8.6kg and 10.5kg

Bernard Taylor
Mar 2020