Oxford Diocesan Guild of Church Bellringers

Towers and Belfries Committee

Technical Note No. TBC04 – Issue 1

CLAPPER BUSH WEAR

Introduction

The clapper, hidden away inside the bell, is one of the most neglected elements of the mechanical system that makes up a bell hung for full circle ringing.

Basically there are two methods of suspending a clapper within a bell to allow it to swing with the bell.

In very old bells the clapper is suspended on a “baldrick” from a wrought iron staple (“U” shaped bar) cast into the underside of the crown. The many issues with this arrangement are not the subject of this Technical Note.

In modern bells the clapper is suspended from an independent crown staple, the fixing bolt of which passes through a hole in the centre of the crown of the bell and in the headstock and is held in place by a nut bearing on the top of the headstock, as shown in Fig.1.

The bearing in this type of clapper is the subject of this Technical Note.

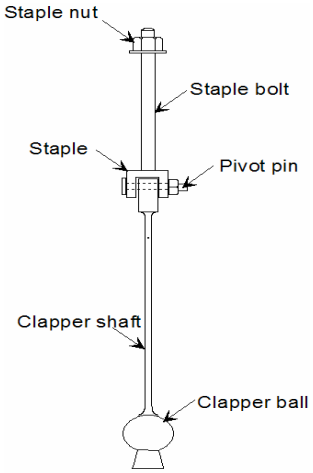


Fig. 1
Clapper and Independant Crown Staple Assembly

The Clapper Bearing

The bearing that enables the clapper to swing is a very simple plain bearing comprising a “U” shaped staple with a hole in each leg of the “U”. The flattened head of the clapper shaft, which has a hole bored through it, is inserted between the legs of the “U”. A pivot pin passes through the holes holding everything together. See Fig.2.

To prevent the hole in the clapper head wearing as the clapper swings to and fro it is lined with a sacrificial bush, designed to wear and be replaced at regular intervals.

In older installations the bush could be made from leather, gunmetal or nylon, Modern practice is for the bush to be made from Tufnol, a type of plastic, which may be encased in a resilient neoprene rubber sheath.

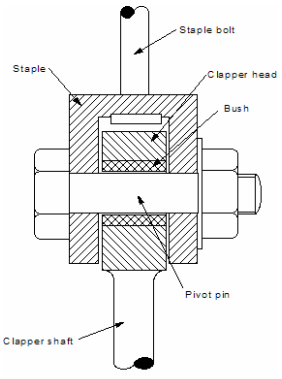


Fig.2
Section Through Clapper Head and Independant Crown Staple Un-worn Bush

The bush, irrespective of the material from which it is made, is a forced fit in the hole in the clapper head and is a close fit to the pivot pin. The whole assembly is intended to

transfer the forces evenly along the length of the bush from the swinging clapper to the pivot pin.

Where the bush is encased in resilient rubber this is intended to reduce the shock load and improve the life of the bush.

To ensure that the minimum force is transmitted through the bush the clapper must be aligned in the bell to swing in the same plane in which the bell rotates, see Figs. 3 & 4.

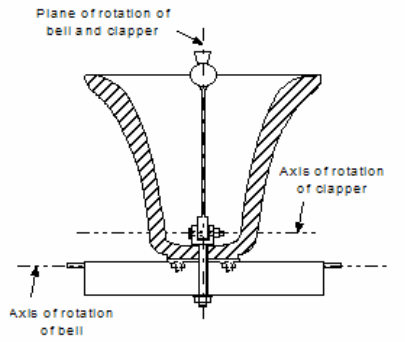


Fig.3
Section Through Raised Bell
Clapper Correctly Aligned

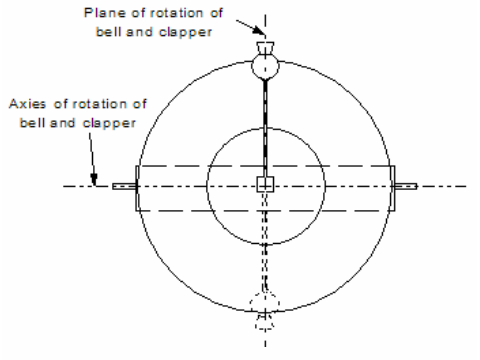


Fig.4
Plan - Bell Up
Clapper Correctly Aligned

If the clapper becomes misaligned in the bell it will try to swing in the same plane as the bell.

As a result the bush is twisted against the pivot pin and high impact loads are generated at opposite ends of the bush as the clapper strikes. See Fig.5.

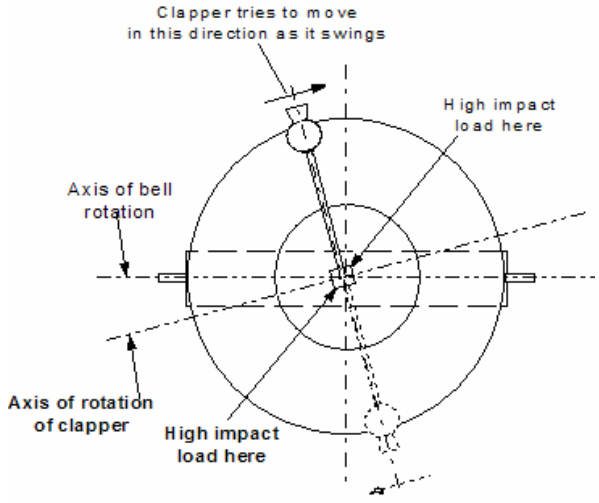


Fig.5
Plan - Bell Up
Clapper Mis-aligned

Over a period of time the bush material breaks down where it is subject to repeated high impact load so that eventually the clapper can swing from side to side. See Fig.6

As a result of clapper misalignment and bush wear there may be increasing difficulty in striking the bell accurately.

In addition an increasingly wide indentation will be worn on the soundbow of the bell where the clapper strikes it randomly.

If not corrected, the bush will wear through and the pivot pin will be in direct contact with the metal of the clapper. This will result in the hole in the clapper head becoming oval, making the eventual re-bushing more difficult and expensive. It will also damage the pivot pin which may have to be replaced.

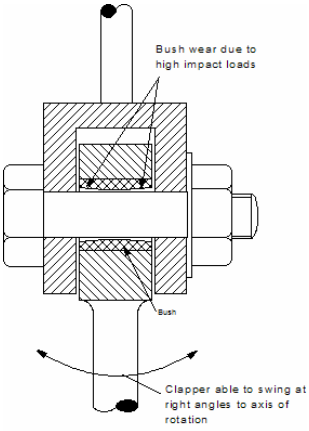


Fig.6
Section Through Clapper Head and Independant Crown Staple Worn Bush

Checking for Bush Wear – Bells MUST be DOWN

With the clapper hanging in the centre of the bell lift the clapper vertically, there should be no more than 1 – 2 millimetres of movement (although this is not critical). If the movement is considerably more this is a sign of bush wear.

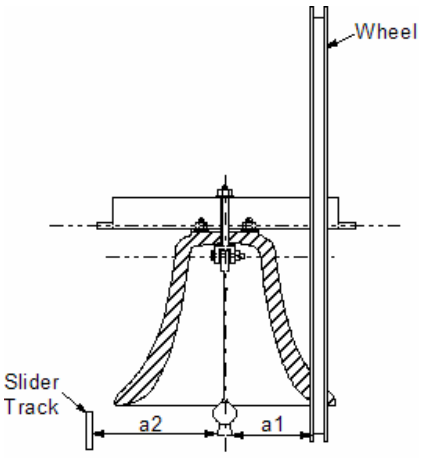
Next, try to swing the clapper at right angles to its plane of rotation (its normal direction of movement). See Fig 6.
If the clapper can be moved more than 1 centimetre either side of the vertical then this is an indication that the bush is worn. Significantly more than this would indicate that the clapper should be re-bushed.

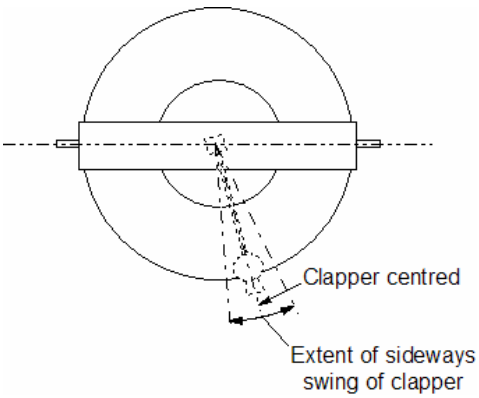
Maintaining Clapper Alignment – Bells MUST be DOWN

Maintaining the correct alignment is a relatively simple process but is best done as a two person task.

Start by measuring how much the clapper is out of alignment. Select a firm datum under the bell that is parallel to the plane of rotation. This could be the wheel (if it is not buckled and is mounted vertically and at right angles to the headstock) or the slider track.

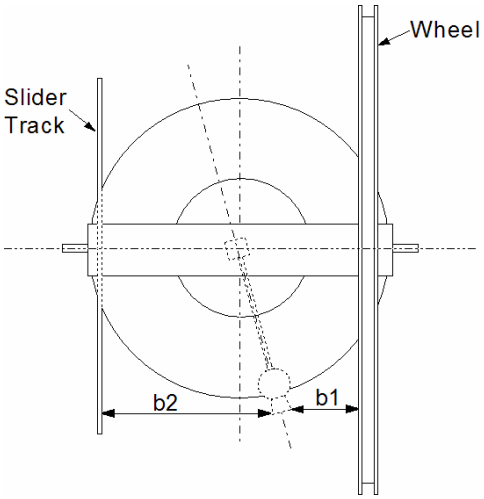
With the clapper hanging vertically in the bell measure the shortest distance from the ball to the chosen datum using a pair of callipers or a locking tape measure. It may be easier to measure from a distinct point on the clapper flight. Make a note of measurement *a1* if using the wheel, or measurement *a2* if using the slider track (see diagram).





If bush wear has already occurred and the clapper can be swung from side to side, as described above, then it will be necessary to centre the clapper before taking the next measurement.

Pull the clapper so that it touches the soundbow. Swing the clapper to the left and note the extent of the movement along the soundbow. Swing the clapper to the right and then position the clapper so that it is centred at the mid point between the two points marking the extent of the swing (see diagram).



Holding the clapper in this position and using the same point on the clapper, measure the distance to the same datum. Make a note of measurement *b1*, or measurement *b2* (see diagram).

Calculate the difference between *a1* and *b1,* or *a2* and *b2*. If the two measurements differ by more than 6 to 8 millimetres then the clapper needs to be re-aligned.

To ensure that the staple nut remains tight its rotation is prevented, usually, by a lock nut, tightened down onto the staple nut, or the staple nut is castellated and the pair of the slots, forming the castellations, are aligned with a hole through the staple bolt and the nut secured by a slit pin inserted through slots and hole.

If the staple nut is not secured in this manner there is a real danger of the staple nut working loose and the clapper flying out of the bell as it is rung.

The second person now removes the lock nut or split pin and slackens the staple nut on top of the headstock, just enough to allow the clapper to be twisted in the bell.

Pull the clapper against the soundbow and move it sideways in the direction that reduces the difference between the two measurements. If measurement *b1* is less than *a1* move the clapper away from the datum; if *b1* is greater than *a1* move the clapper towards the datum. Repeat the measurements, remembering to centre the bush wear as before, and adjustment until the difference in the two measurements is as close to zero as practicable.

With the clapper touching the soundbow, move it gently anticlockwise until it just meets resistance. Hold the clapper firmly in this position while the second person partially tightens the staple nut until the clapper can no longer be twisted in the bell.

Recheck the centring and measurements and if there has been movement repeat the adjustment process. If there is no change complete tightening the nut using the tightening procedure above. To prevent the staple nut working loose do not forget to replace and tighten the lock nut or replace the split pin.

If the clapper alignment is checked regularly as part of the schedule of routine maintenance then clapper bushes should last significantly longer.

It is possible for the nut securing the pivot pin to work loose allowing the pivot pin to wear the staple holes oval, eventually necessitating a new staple. It is very worthwhile when checking the clapper alignment to check the security of the pivot pin and tighten the nut as necessary to prevent this happening.

Disclaimer
This technical note and its recommendations are given gratuitously and in good faith but expressly without liability on the part of the Oxford Diocesan Guild or any officer or member thereof, or any person who has been concerned in the preparation of the note. The Towers and Belfries Committee exists to encourage the keeping of bell installations in the Oxford Diocese in good order and is pleased to be asked to assist with advice on maintenance or major work on an installation.

Contacting the Towers and Belfries Committee
More information on any aspect of tower maintenance can be obtained from the Secretary: Mark Walker, 9 Pykes Close, ABINGDON, Oxon OX14 2QL.
Tel: (01235) 536159, email: mark@wagglewaggle.co.uk.

December 2012