



CLAPPER NOTES

Quality is defined as warmth in the heart of the customer

Builders and carpenters know that the doorstep of a door must be positioned correctly if there are to be no impulses sustained by the hinges of the door. For a plain door of uniform material and thickness the correct position of the doorstep is horizontally distant from the hinges by two-thirds of the width of the door. This position is known as the centre of percussion. The skilled man hands down the two-thirds rule to his apprentice, thus passing the knowledge from generation to generation. If the doorstep is otherwise positioned the door loosens on its hinges or the hinges loosen on the wall. This harms the skilled man's reputation.

Cricket, baseball, golf and tennis players swing a bat, club or racquet to apply an impulse to the ball, so as to propel it fast and accurately. Improvements in the design and manufacture of specialised sports tools have taken place, developmental steps have been made by trial and error, and account has been taken of the opinions of players. It has been found best for the player's hands to feel no impulsive reaction at the instant when the bat, club or racquet strikes the ball. When this is so, the whole of the angular momentum applied to the sports tool by the player has been converted into the impulse on the ball and none of the angular momentum provided by the player has been wasted. The correct point on the sports tool has been used to strike the ball. This point is known as the centre of percussion. Its position is dependent upon the materials, shapes, relative shapes and overall shape of the sports tool and its components.

Church bell founders and hangers know the importance of the centre of percussion. To produce a good sound from the bell the clapper ball must deliver a substantial impulse to the sound-bow. At that instant the clapper ball receives from the sound-bow a reactive impulse of equal magnitude. The composite body of shaft, ball and flight bends in response to that impulse and vibrates briefly in bending mode. If the centre of percussion of the clapper is coincident with the centre of the ball, as it should be, there is no impulse at the clapper suspension bearing. If the centre of percussion of the clapper is not coincident with the centre of the clapper ball an impulse takes place at the clapper suspension. The magnitude and direction of action of this unwanted impulse are dependent upon the clapper's material profile and shape profile along its length. Associated with the unwanted impulse is an increased risk of failure of the clapper, crown staple or clapper suspension. The design features which determine the position of the clapper's centre of percussion are the sizes, densities, homogeneities, shapes and proportions of the clapper shaft, ball and flight; and their relative sizes, densities, shapes and proportions in combination. The shaft and flight should be conical along their lengths. The shaft should be slimmer at the suspension end. The flight should be long, stout, conical, and slimmer at the ball end. The shapes of the shaft and flight should blend into the shape of the clapper ball without abrupt discontinuities.

There have been instances reported of clappers breaking in the shaft, and of clapper pivot assemblies wearing prematurely. A supplier of clappers for church bells can perform a check on the position of the centre of percussion, for each design/size of clapper, using a well-braced fabricated steel test rig. A bracket, rigidly mounted on the rig via a load cell sensing horizontal impulses, supports the pivot assembly of the clapper under test. Initially the clapper is positioned on the rig with the shaft horizontal and the flight supported on a latch. The latch is then released and the clapper swings freely downwards under gravity through 90 degrees of arc until its ball impacts horizontally against a massive anvil mounted rigidly onto the base of the rig. The anvil represents a portion of the bell's sound-bow. If the centre of percussion is not coincident with the centre of the clapper ball, an impulse is sustained by the clapper suspension and the electrical output from the load cell gives an indication of the amount by which the centre of percussion is distant from the centre of the clapper ball. If on the other hand the centre of percussion of the clapper is coincident with the centre of the clapper ball, as it should be, no impulse is sustained by the clapper suspension and there is no electrical output from the load cell.

In this age of advancing technology it may be reasonable to expect that suppliers and installers of clappers shall, as standard practice, perform tests to provide the assurance that the centre of percussion is properly coincident with the centre of the ball. This will benefit suppliers, installers and customers alike.