



Cranfield University - Royal Military College of Science

The Effect of Barrel Obstructions on Shotgun Barrel Failures

This report is a precis of work undertaken at Cranfield University, Royal Military College of Science as part of the requirement for the award of a Masters Degree in Forensic Engineering and Science, and was sponsored by the Birmingham Proof House and the British Association for Shooting and Conservation. The original report written by Mr. Sam Shayegan is available from Cranfield University at the Royal Military College of Science from Dr. DF Allsop who supervised the work and prepared this precis.

Introduction

Shotguns that are well maintained are safe and reliable and very rarely fail if correctly used. If they do fail it can lead to injury to the firer, and possibly bystanders. In the rare case that they do fail the most frequent cause is the inadvertent obstruction of the barrel by a foreign body. An investigation into the effect of different obstructions at different positions in the barrel was recently completed at RMCS and has helped to identify the probable type of obstruction and its position in the barrel to cause different levels of damage. This work was of a qualitative nature and has been followed up by an investigation that gives quantitative results and is reported below.

Test Procedure

A strengthened weapon fitted with pressure transducers was used to measure the peak pressure generated by different levels of obstruction and compared with the pressure generated by a standard unobstructed cartridge and an unobstructed cartridge loaded to generate proof pressures. The configuration of the test barrel is shown in Fig 1. Strengthening collars were brazed onto the barrel where peak pressure occurred due to the presence of different obstructions. A pressure transducer was fitted to the collars to measure the peak pressure generated. Previous work indicated that an obstruction of 4 grams would lead to the barrel bulging and an obstruction of 14 grams would lead to the barrel busting. Obstructions of different masses ranging from 4 grams to 14 grams were positioned in the barrel at different points along its length coinciding with the pressure transducer tappings and the pressures measured for a cartridge loaded with 28 gram of No.6½ lead shot with fibre wads.

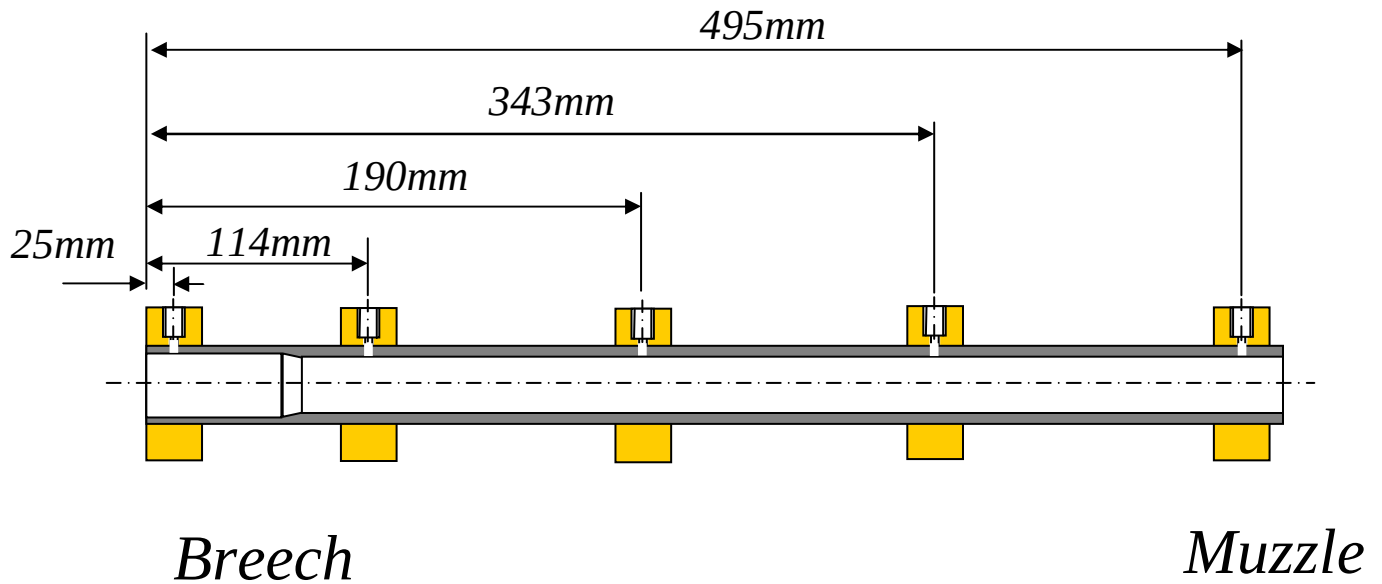


Fig 1. Configuration of 12 gauge test barrel used to measure pressures generated for different obstructions at different points in the barrel.

Test Results

Fig 2 shows the pressures generated by a conventional 12 gauge cartridge loaded with 28g of No. 6½ shot (English) and for a cartridge loaded to proof level pressures.

Fig 3 shows the pressures generated when firing the same conventional 28g cartridge but with obstructions of different masses placed in the barrel. The rise in pressure due to the obstruction is very local and it has been found that the peak pressure occurs 22mm beyond the leading edge of the obstruction. The obstructions were created by lead shot sandwiched between two plugs of tissue paper.

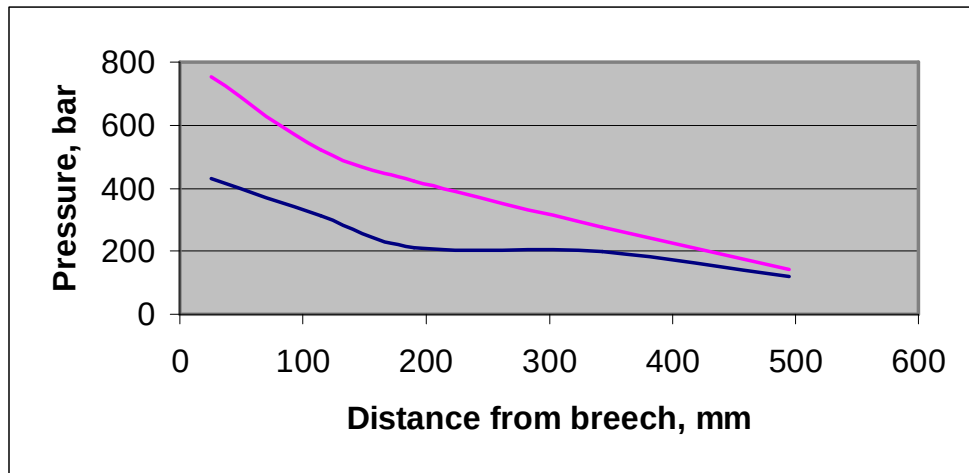


Fig 2. Pressure generated along the length of a 12 gauge barrel when firing a standard 28g load and cartridges load to proof levels of pressure.

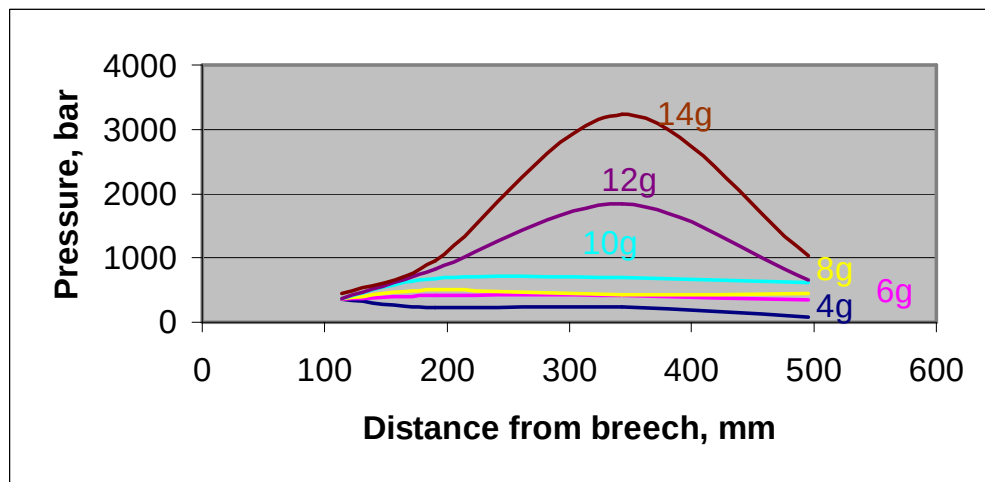


Fig 3. Peak pressures generated along the length of a 12 gauge barrel when obstructions of different masses are placed at different points in the barrel.

If Figs 2 and 3 are compared it can be seen that even with low mass obstructions the local pressure generated because of the presence of the obstruction considerably exceeds the normal pressure of firing and the pressure to which the weapon is proofed. From a knowledge of the barrel wall thickness and the material properties of the barrel it is possible to estimate the bursting pressure of the barrel. Thus for a burst barrel it is possible to estimate using Fig 3, the minimum mass of the obstruction that causes the burst.

Recommendations

An obstruction weighing 4 gram is that of two fibre wads and is sufficient to bulge the barrel on a well made gun and to burst thin walled barrels. The bulge caused by an obstruction is typified by a ring bulge that is very costly to repair. A burst barrel may well cause injury to the firer and to bystanders and would result in a very expensive repair that may be more than the value of the gun. It is essential that a gun is not fired with **any** form of obstruction in the barrel. When a gun is loaded for the first time it is important to check first that the bores are clear. They should also be checked at any time there is the slightest possibility that they may have become obstructed with mud, snow or any other foreign object. If at any time an unusual noise occurs during firing it is important to check the bores in case a wad has become lodged in the bore due to a faulty cartridge.

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Rec sec\publications\RMCS Barrel Obstructions
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