

## **‘Blown’ Patterns and ‘Balled Shot’**

As greater numbers of shooters are now insisting on fibre only cartridges for the vast majority of situations, we would do well to appreciate that there are less than immediately obvious potential shortcomings with this choice of load. It is undoubtedly true that they are less unsightly than the standard plastic variety when encountered on the ground; but apart from the lack of protection afforded to the shot pellets by a shot cup on their journey down the barrel, there are other factors at play: with some of them being of a rather sinister nature.

For longer or higher birds the plastic wadded cartridge is generally preferred, but for shots at medium ranges the ordinary fibre load will hold its own quite well. Attempting to use cartridges that are too long for the chamber of a given gun is clearly not good for the health of the shooter or the gun; but what about the use of shorter loads in longer chambers?

Firstly, it is not to say that there is anything intrinsically wrong with a fibre-wadded load, but we must be aware of the limitations of some types of these wads, especially when utilised in certain guns with chambers longer than ideal for the cartridges in question. Going back to basics, the purpose of the wad is not as straightforward as might be imagined. It plainly separates the shot from the powder charge, but this is because without a wad at all there would be no realistic sustainable forces to act on the individual pellets, from the rapid expansion of the extremely hot gases after the ignition of the powder.



**The impact on the pattern plate of the entire shot charge welded into four clumps of ‘balled’ shot (one larger and three smaller) caused by hot powder gases leaking past the wad, when a shorter fibre wadded 2¾ inch (70mm) cartridge was fired in a 3 inch (76mm) chamber.**

The foremost task of the wad is to prevent the leakage of these gases into the shot charge, as not only will there be a loss of muzzle velocity if they in fact do so, but the pattern quality will be adversely affected to the detriment of downrange performance. The

powder gases can and do, disrupt the normal displacement of the pellets as they rapidly travel the length of the barrel. As well as this negative effect on the pattern, they can also literally weld clumps of pellets together; even though the fraction of a second available for them to do so might appear to render insufficient time for this to take place.

Unfortunately, in achieving their unpleasant goal, the powder gases get a lot of help from other areas, such as the cushioning abilities of the wad column, or the relative lack of them. To explain further, it must be appreciated that in order to effect the welding of groups of pellets into a cohesive single mass, not only is direct heat from the gases at work required, but also the very high compression forces of extremely rapid acceleration acting upon the pellets. These forces of high compression also heat up the pellets, but have the effect of lowering the temperature at which such welding is able to occur; this is especially felt amongst the rearmost pellets that receive the greatest degree of compression. So for clarity, if a wad's ability to cushion the shot charge from these forces is rather less than ideal, the likelihood of there being compression welded (or cold welded) pellets is significantly increased.

If in addition to this, there is also a tendency for leakage of hot powder gases to invade the pellets, then the chances of relatively large clumps of pellets being welded together into a single mass becomes much more likely. This can result in what is termed 'balled' shot, clusters of pellets that can travel far out of usual shotgun pellet range (400yds plus); being capable of inflicting serious injuries or even death to third parties.

This unpleasantness is indeed what happened to an acquaintance of mine whilst indulging in some testing at the pattern plate recently, and served as a rather blunt warning of the unsuitability of this particular gun and cartridge combination; but what exactly was the cause of his trouble?

Having witnessed the damage to the pattern plate that initiated his concern, things were clearly not well in the manner of delivery of the shot charge. A 70mm (2¾ inch) cased fibre wadded cartridge was fired in a 76mm (3inch) chambered gun; four deep dents subsequently appeared in the surface of the pattern plate (which was of 3mm thick steel). After an examination, gas leakage appeared to be the main culprit, as the wad was not designed to cope with

having to expand into the full diameter extra chamber length, together with the increased compression placed on the small pellets when undergoing rapid acceleration.



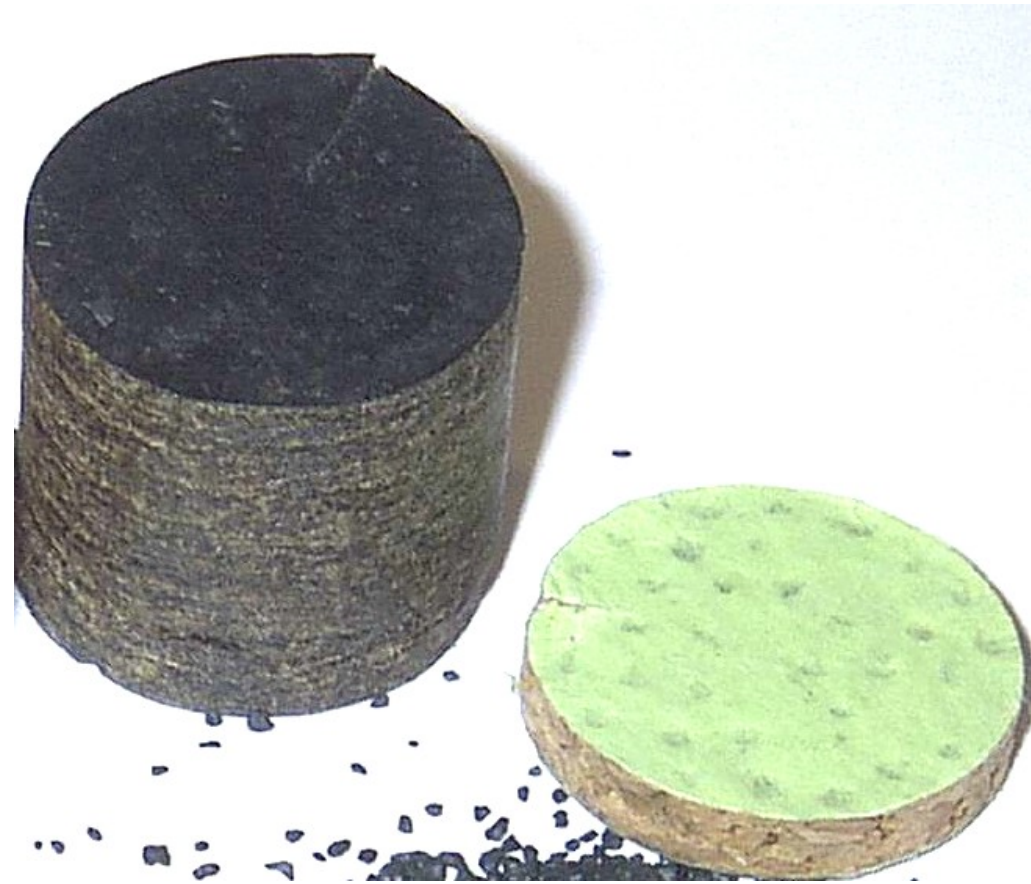
**Above both left (front) and right (rear): The main 'balled' part of the charge seriously damaged the pattern plate, nearly breaking through it completely!**

The smaller shot sizes will suffer to a greater extent from this type of damage, as they are easier to weld with both the hot gases, and the compression forces of rapid acceleration.

This may seem unlikely as the chamber was only 6mm or so longer than the case, but if it is appreciated that somewhere in the region of 8000psi is pushing hard at the rear of the wad whilst it attempts to breach the transition from case to chamber and finally into the bore; unless there is a very good gas tight seal, some of this gas will force its way past the wad, and into the shot.

Most fibre wads used for game shooting cartridges tend to be of a basic vegetable fibre type (right), which although reasonably efficient in chambers of the correct length, are fighting a losing battle when they are asked to perform tasks that are quite beyond their physical capabilities.

The main reason for the use of these utilitarian types of wad is one of cost, as the cartridge market is notoriously driven by the retail price of its ammunition. Better, more efficient wad materials exist, but they are to be had at a price that the typical shooter will not pay. Indeed, even in some game shooting circles the cost of ammunition appears to be an area where false economies are regularly practiced, which when the expense of some of the guns that are employed in this field is considered, let alone the price to be paid per bird; is patently ill advised.



Perhaps we may never again revisit that golden era of the general use of genuine white wool felt wads and paper cases, and the gas sealing abilities of the same that were beyond reproach. Unfortunately their high unit cost sounded the death knell of this utopian state of affairs well before the start of the 2<sup>nd</sup> world war. It is still possible to obtain genuine felt wads, but few people are prepared to pay upwards of £350-£400 for a 1000 specially loaded lead shot 12 bore cartridges. There is also a sort of 'half way house' wad available that is comprised of a cork and felt 'sandwich', which although an improvement over the standard fibre item as far as gas sealing potential is concerned is not as yet generally loaded, being more expensive.

So what can we do to eliminate the potential safety problems of balled/clumped shot with fibre wads?

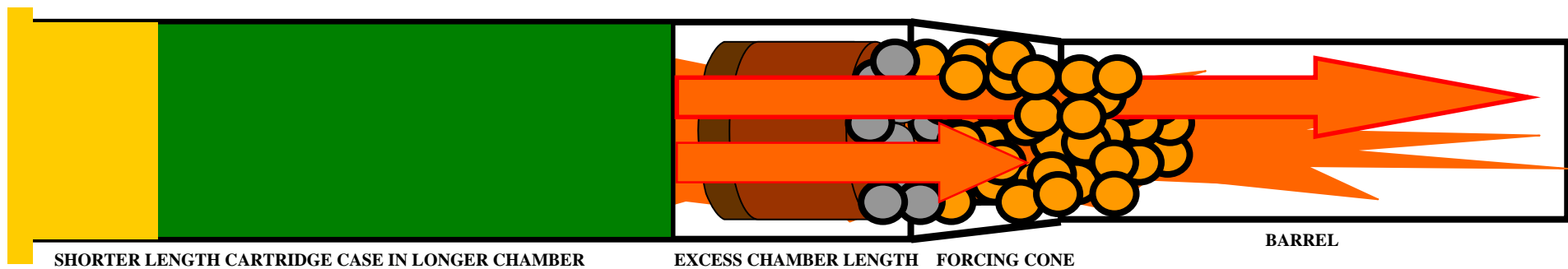
Perhaps the most cost effective method would be to replace the hard thick card over powder wad with a thin gas seal, but one being produced in a suitable photodegradable material. The gas seal will degrade and is tiny when compared to a full sized plastic wad.

These types of gas seals have been loaded before, but they were only available in standard plastic materials, with many loads having to revert to the older thick over-powder card to comply fully with the fibre only directives; at the expense of consistency and potential safety downrange when inappropriately used in long chambered guns.

However even when these improved types of components are generally available, it is probably still not a good idea to fire shorter cased fibre wadded ammunition in longer chambers; with their vastly increased chances of the 'balling' of the charge, posing a potentially dangerous hazard to persons unknown and out of sight, at distances considered well out of normal range.

Balled shot may not occur with every shot, but it can and does happen more frequently than might be supposed.

Perhaps a fair (although perhaps rather necessarily brutal) analogy of this would be the farmer who regularly pulls out of his farm track onto the village lane without bothering to look for oncoming traffic, he gets away with this for nine times in a row; but on the tenth occasion he is hit and killed by a juggernaut. As far as .410 shotguns are concerned, fibre wadded 2.5inch shells fired in 3inch chambers cannot possibly be expected to perform in a consistent and reasonable manner.



**As the standard fibre wad clears the end of the shorter cartridge case it enters the section of full diameter longer chamber but it has insufficient elasticity to expand and effect an efficient seal until it reaches the end of the tapered chamber cone and enters the bore; allowing a considerable portion of the hot powder gases to escape past it and infiltrate the shot charge. In doing so they can effectively weld portions of the shot charge together creating the potentially very dangerous condition known as 'Balled shot'.**