GUNSMITH:
BOB JAMES
Montana Long Guns
Email: poi@mtlongguns.com

BALLISTICS:
TIM WOODHOUSE
Light Gauges
Email: nicolasmedia@btopenworld.com

COACH:
WILL FENNELL
Email: willfennell@willfennell.com

EACH ISSUE, OUR PANEL OF EXPERTS, GUNSMITH BOB JAMES, BALLISTIC EXPERT TIM WOODHOUSE AND COACH WILL FENNELL, WILL ANSWER YOUR QUESTIONS

I HAVE BEEN SHOOTING FOR THREE YEARS USING AN OVER/UNDER THAT MY FATHER SHOT FOR MORE THAN A DECADE BEFORE ME. ITS BEEN WELL MAINTAINED BUT THE CHECKERING AROUND THE HAND GRIP AREA IS SHOWING DISTINCT SIGNS OF WEAR. WHAT'S INVOLVED IN HAVING IT RE-WORKED?

Bob says

With the service you have received from this fine gun, I would imagine it has a few love marks on the wood, meaning the entire stock and fore arm could stand refinishing to bring it back to original. If this is so, and it is your choice, the refinishing should be done first. Then the re-checkering is done being achieved by a professional using a hand tool made specifically for this job. This is an art, do not attempt to try it on a good stock without some experience. The checkering tool is hand held and will cut one line at a time. It cuts on the push stroke. Each stroke is about 1/2 of an inch. Each line is individually cut and normally we will go over each line three times.

After the lines are cut, we will go back over the entire pattern and work out the end of each line to the border of the pattern. After inspection, the checkering is sealed to protect from moisture.

With refinishing and checkering, your shotgun should be better and more beautiful than the original. The time involved for a professional on a standard 682 Beretta pattern (for example) should be about 4 hours and for an amateur 16 hours plus. Check it out – the investment will be worth it.

I HAVE NOTICED THAT SOME SHELLS SEEM TO KICK HARDER THAN OTHERS, EVEN THOUGH THEY ARE OF THE SAME SHOT WEIGHT AND PERFORMANCE. IS THERE A RECOIL RELATIONSHIP BETWEEN POWDERS AND PRESSURE?

Tim says

It is usually assumed that the recoil of a shot shell is the sole product of its shot load and velocity, and with same load types using a pendulum

gun, the tester would be hard pressed to differentiate between the mechanical readings for differing brands of ammunition.

All of us have an individual perception of what amount of 'felt' recoil is acceptable. The variable is the speed of pressure rise together with the peak level and duration of this pressure when a certain type of shell is fired. The body has to have time to notice this force (via the shoulder), before it can react accordingly.

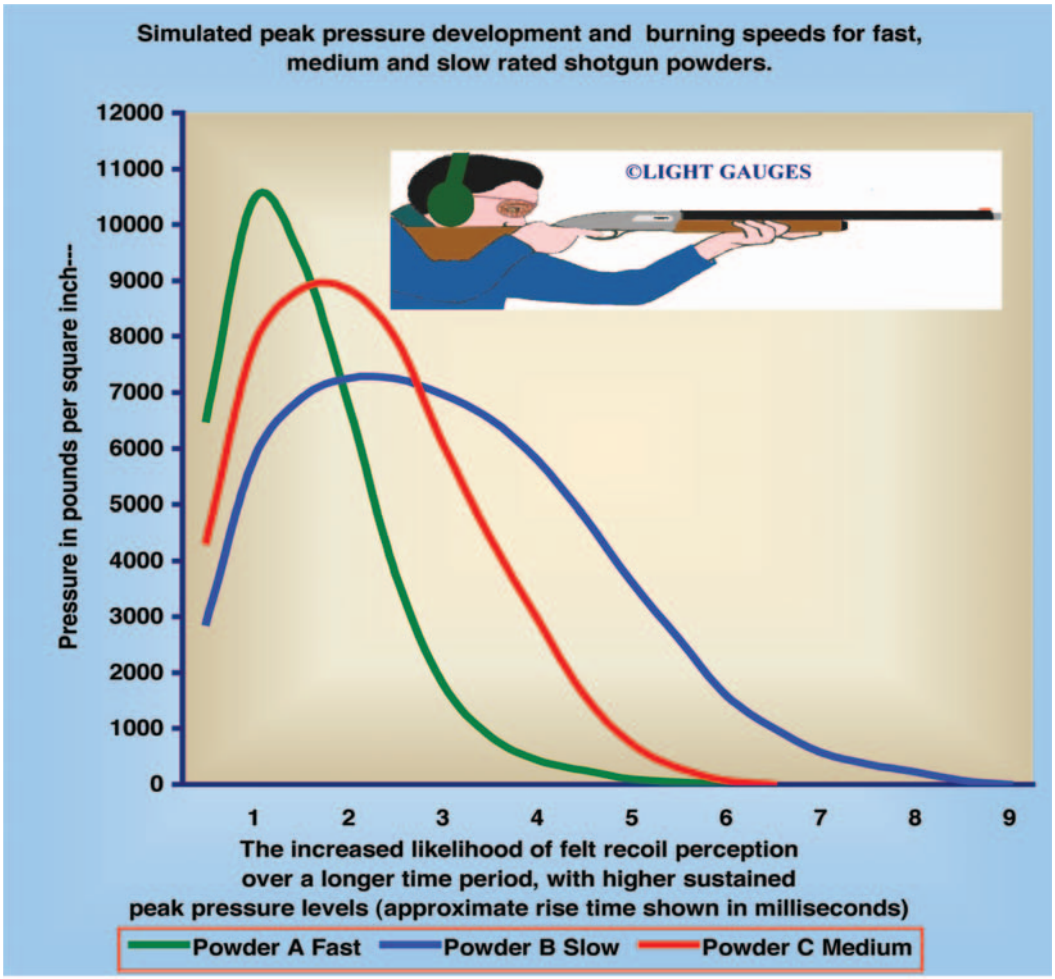
In a hypothetical situation, one particular type of shell (X) may be ideal for Shooter A, but intolerable for Shooter B, whereas Shooter B's favorite load (Y) might not suit Shooter A, but may be reasonably tolerable for Shooter C, whose actual preference lies elsewhere with shell (Z). All of these scenarios assume guns of sufficient weight that fit the shooter and being suitable for the shot loads concerned.

If there are two loads of identical velocity and component weight, what causes one to be uncomfortable and the other a pleasure to shoot? A lighter load, using fast powder A, if the peak pressures are not overly high, can give a good impression – as there is little time for the sensation to register with the nervous system before it has already dissipated. It's like the rapid removal of a Band-aid self stick dressing from a wound, as opposed to the prolonged pain of a slower approach. In this case, the sensation of recoil is over too soon to be picked up and registered for its full effect, so the felt recoil would be less, and the shell more comfortable to shoot.

Another way to achieve this level of reduced felt recoil is with a load using powder B. This makes use of a considerably slower powder than powder A to keep the peak pressure developed to a much lower level – maintaining a higher degree of thrust further down the bore. A good analogy of this felt recoil effect would be the considerable reduction afforded by the gas-operated automatic shotgun when firing identical ammunition as a stack-barrel shotgun of identical weight. The recoil pulse is considerably extended and takes a longer period of time to transmit to the shoulder, with the peak forces being reduced. The mechanical absorption of part of the recoil by the gun's action matches the reduced felt recoil effects with the lower peak pressure of a load using powder B.

Powder C, although slower than powder A, is faster than powder B. Powder C loads are perfectly safe, with the peak pressures being within the service limits, reaching a slightly lower level to powder A, but with a longer duration. This looks fine on the chart, but it can manifest itself as a much higher level of perceived or felt recoil at the shoulder for some shooters. Although the peak pressure is maintained for only slightly longer than powder A, it is more easily registered by the central nervous system, resulting in the shooter being more aware of the recoil. Returning to the Band-aid dressing analogy with powder A, it has been removed more slowly with powder C, and it hurts!

So if the shell peak pressure is higher, but relatively short in duration, the recoil sensation will not normally be felt for its true potential (as in the load with the faster pressure rise time powder A). If of a much longer duration, but with a considerably lower shell peak pressure, the felt recoil will also be acceptable (as in the load with the slower pressure rise time powder B). But when the peak pressure is nearly as high but also lasts just a little bit longer, then it will feel as if the cartridge has heavier recoil (as in the load with the medium pressure rise time powder C).



ARE MIDI TARGETS HARDER TO HIT THAN STANDARDS? SOME SHOOTERS SEEM TO TREAT THE TWO VERY DIFFERENTLY – IS THIS REALLY NECESSARY?

Will says

Midi's can fool a shooter because of their slightly smaller size and

MIDI TARGETS NEED YOUR FULL FOCUS.

the fact that they come off the trap arm "hot", but loose speed a bit faster than a regular clay. First, the shooter will assume the target is a bit further than it really is, and then it's all to easy to build gunspeed based on the speed of the clay when you first see it (really fast) and then overspeed the clay with the gun in the killzone.

Add to this the fact that they are smaller, and therefore harder to lock your focus onto, and you can give yourself many stumbling blocks to a successful shot. I always make sure what the actual target is that is going to be thrown, and when I see that it is a midi, I pay extra attention to the actual distance of the clay in the killzone. I try to estimate this based on the terrain that the clay passes to minimize being fooled by its diminutive size. Then I work hard to access what the target is really doing (speed and angle) in the killzone, not what I see early in its flight. I generally use the same choke and shell choice that I would for a standard clay at the same range and flight height.

HOW DO YOU REGULATE THE TRIGGER PULLS TO A SPECIFIED POUNDAGE AND WHAT POUNDAGE DO YOU SUGGEST FOR A SPORTING CLAYS COMPETITION GUN?

Bob says

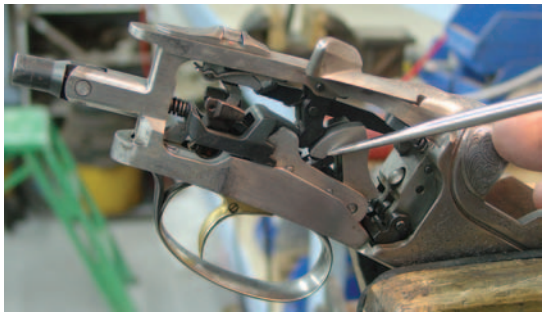
For a competition gun, I would recommend $3^1/_2$ to 4 lb triggers. Poundage doesn't seem to be as important as does how crisp the pull is. They should release with a short, crisp pull. On an over/under it is imperative that both triggers are the same. How this is achieved is not easy as there are as many variation of triggers and sears as there are brand names. Some O/Us may have as many as four parts that need to be matched, polished, and timed while others only have two. Side x Sides, Box Lock and Side Plated guns (or back action guns) are quite different while the auto and pump gun are quite similar.

Let's take the average O/U. In most cases, we need to reduce the poundage and trigger creeps. First the gun is disassembled and examined. Normally we will change the angle of the sears as well as shorten the engagement surface. The sears are polished to a mirror finish with a 1000 Grit diamond stone. Most O/Us have an inertia barrel selector which is like a sear but not as critical.

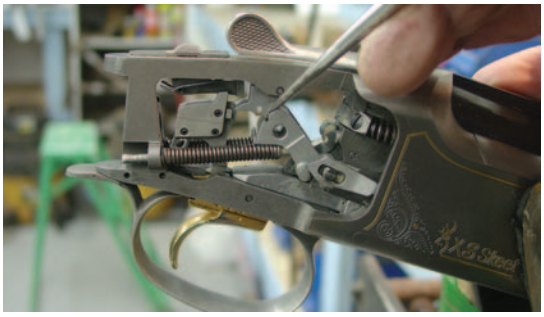
Of course, there are springs which can be too heavy or too light or have a difference between the two. Sometimes, there is built in free travel in the trigger that must be addressed. I don't know of an absolute way to grind distances, angles and springs that would guarantee first time success.

The gun is modified, assembled, lubed, and test fired. You can almost bet that it will not be perfect first time, but if you have many years of experience, it will be very close. After it's analyzed, you will have an idea of which part to change and how much. This process is repeated until perfect. Most of the time we can get it the second or third time – but there is always the one which will drive you nuts! Though 'parts' may be cheap, the cost of adjusting and regulating trigger pulls lies in the labor.

Most important is safety. After adjustment, always make sure it will hold if dropped or bumped. Always run a couple of boxes through rapidly for heat.

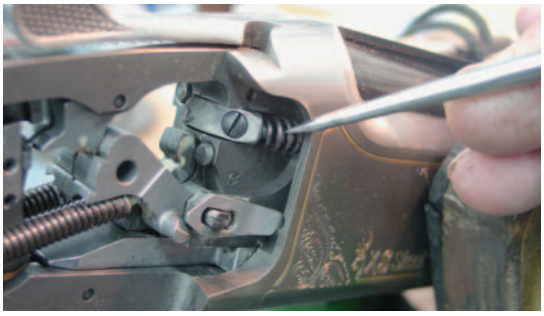


NOTE PARTS AND SEARS ON BACK AND BOTTOM.



TOTALLY DIFFERENT, NOTE SEARS ON BACK AND TOP.

NOTE PARTS AND NO SEARS.



TOP LEVER RETURN STRING.

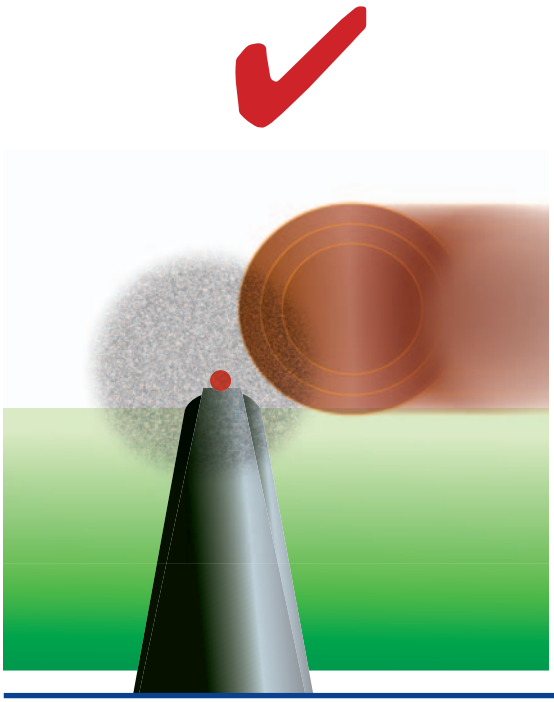
RABBIT TARGETS ARE MY BOGEY TARGET. STRANGELY ENOUGH, THE FURTHER AWAY THEY ARE I FIND THEM EASIER. CLOSE SLOW CROSSERS OR FAST QUARTERING RABBITS ARE THE HARDEST. ANY TIPS?

Will says

Rabbits are a " high anxiety target". They really get shooters nervous. The bouncing and the close proximity to the background (the ground) makes the target appear much faster than it really is. All this adds up to the shooter generally moving the gun way faster than the target requires.

I would say that the vast majority of rabbits inside 30 yards are missed infront. The shooter almost always guesses that he is behind, as the eyes close during recoil, and open to see dust behind the target, fooling the shooter.

Close, slow crossing and quartering rabbits take very little lead. These are some of the few targets that I teach maintained lead to engage. Hold the front edge of the rabbit and match the speed to keep the gun from outrunning the target and you will be fine.



I SHOOT A 7 YEAR OLD BROWNING THAT IS SHOWING SIGNS OF SHOOTING 'LOOSE'. MY LOCAL GUNSHOP SAYS THE GUN IS OFF THE FACE AND NEEDS REJOINTING. SOUNDS EXPENSIVE – WHAT'S INVOLVED?

Bob says

I am assuming your Browning is an over/under. It is not normal for a Browning to shoot loose at the hinge pins; however, there is always that "one". There are at least three things that can cause the gun to shoot "loose".

- The hinge pins can actually be worn and need to be replaced with over size pins (approximately $280.00).
- The locking lug that locks the barrels down tight could be worn and needs to be replaced (approximately $250.00).
- The top lever return spring is probably weak and thus not having the energy to set the locking bar all the way home (approximately $75.00).

I don't generally like to give cost figures because of the many variables, but this should give you an idea of what the costs could be.

WHAT WAS YOUR VIEW OF THE SPORTING TARGETS AT THIS YEAR'S NATIONALS?

Will says

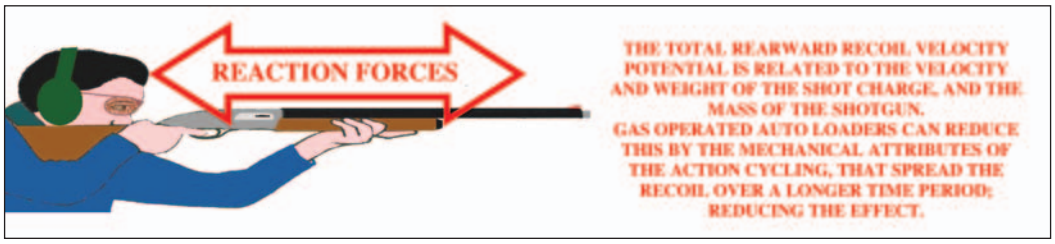
The targets at this year's Nationals were a breath of fresh air compared to the past years presentations. Shooters that have been making the pilgrimage to San Antonio for many years really appreciate changing around the course layouts. Giving us new terrain is truly welcome.

There are still too many quartering birds (partially due to the cramped courses), and not enough crossers, but this year the mix was better than previous years and we must give credit where it's due, and encourage the effort!

It was really good to see Neil Chadwick included as a course setter, but to take Neil, who is probably the most experienced FITASC target setter in the country, and have him set the sub-gauge event did seem to be a waste of talent. If headquarters could see their way to let Chadwick set next years FITASC event, Parcours de Chasse shooters would be extremely pleased – as I imagine would Neil himself!

TARGETS AT THE 2007 NATIONALS WERE A BREATH OF FRESH AIR – BUT STILL TOO MANY QUARTERING TARGETS.

WHAT ARE THE EFFECTS OF THE VELOCITY OF A SHELL ON THE ACTUAL AMOUNT OF RECOIL GENERATED, AND HOW MUCH FASTER WOULD A SHELL HAVE TO BE TO DOUBLE THE RECOIL?



Tim says

Recoil with shotshells is firstly a function of the velocity of the projectile(s), and secondly the weight of the shotgun in which it is fired. An allowance also has to be made for the weight of the powder and wad. The first is the amount of available energy that is pushed back in the opposite direction to the flight of the shot charge, as a direct result of Newton's law – *"To every action there is an equal and opposite reaction"*. The second consideration is the 'felt' recoil, or 'perceived' recoil, which is subjective and is variable depending on the individual shooter or gun.

To answer your question, we must look to the first consideration, which is the 'mechanical' or 'physical' recoil produced by firing a shot shell with a given shot weight, at a certain velocity, and in a shotgun of a specific weight. To take a fair average, the weight of our shotgun will be taken to be 8lbs. We can now establish the recoil force of the shotgun in foot-pounds of energy. The weight of the shotgun will directly affect this, as a heavier gun will have a lower recoil energy level with the same load and velocity. The actual recoil velocity (the speed of the rearward movement to the shoulder) of the shotgun in feet per second, is also dependent on the weight of the shotgun.

So to show a typical example, if we take our 8lb shotgun and fire a first barrel $1^{1}/_{8}$oz load with a three foot velocity of 1200 feet per second, the recoil energy will be 20.4 foot pounds, and the rearward recoil velocity of the shotgun to the shoulder will be 12.8 feet per second. If we then go on to fire a second barrel $1^{1}/_{8}$oz load, but this time with a three foot velocity of 1145 feet per second, the recoil energy will now be 18 foot pounds, and the rearward recoil velocity will be 12 feet per second.

As might be expected, the slower 1145fps second barrel load has less recoil, but although it only has a 3.75% lower three-foot velocity, the recoil energy is actually 11.8% less! However, the shotgun's rearward recoil velocity is down by 6.25%. We can see that the relatively tiny drop in velocity of the load has had a much greater effect on the total recoil energy than might have been supposed – at least by an initially casual consideration.

If we now fire the slower second barrel load in a lighter 7lb 1oz shotgun we can see another change in the dynamics of the recoil. Firstly the recoil energy is now exactly the same at 20.4 foot pounds as the faster 1200fps load in the 8lb shotgun, but the rearward recoil velocity is higher at 13.6 feet per second (plus 13.3%)– being more of a function of the gun's lighter weight.

However to complete the picture, if the faster 1200fps 3ft load is fired in the lighter 7lb1oz gun, and compared with the heavier 8lb gun, then the recoil energy will go to 23.1 foot pounds (plus 13.3%) and the gun's rearward recoil velocity will be 14.5 feet per second (also plus 13.3%).

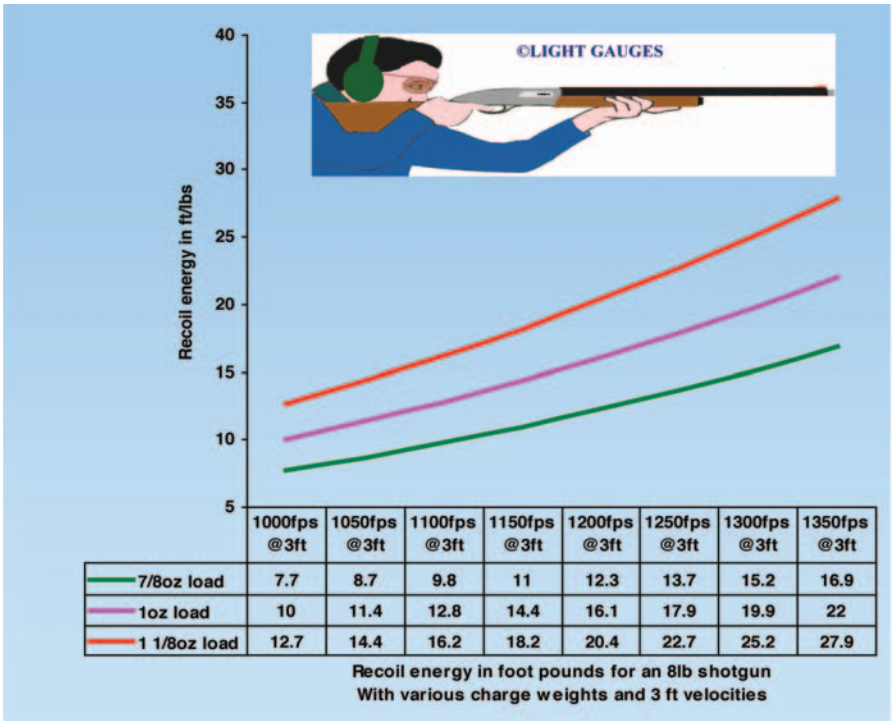
So the lighter gun should have similar recoil energy with the slower load, but might have more 'felt' recoil for some shooters because of the gun's higher recoil velocity: auto loaders can reduce this effect to advantage.

The recoil energy of a typical high speed sporting clays 1oz shell with a 3foot velocity of 1300fps in an 8lb shotgun is 19.9 foot pounds, with a rearward shotgun recoil velocity of 12.6 feet per second.

To double the recoil energy to 39.8 foot pounds with this shot weight, we would have to have a 3 foot velocity of 1677 feet per second (1808fps at the muzzle). The rearward gun velocity would be up to 17.9 feet per second; a 42% increase.

Clearly this is not a load that would be suitable for clay target shooting. It would have identical recoil energy as a $1^{5}/_{8}$oz hunting load with a 1170fps 3 ft velocity.

Other examples of virtually doubling the recoil energy would be the Sub-Sonic $^{7}/_{8}$oz, 1oz & $1^{1}/_{8}$oz loads with 1000fps three-foot velocities, when compared to the same shot weights with 1300fps three-foot velocities (see graph).



	1000fps @3ft	1050fps @3ft	1100fps @3ft	1150fps @3ft	1200fps @3ft	1250fps @3ft	1300fps @3ft	1350fps @3ft
7/8oz load	7.7	8.7	9.8	11	12.3	13.7	15.2	16.9
1oz load	10	11.4	12.8	14.4	16.1	17.9	19.9	22
1 1/8oz load	12.7	14.4	16.2	18.2	20.4	22.7	25.2	27.9

Recoil energy in foot pounds for an 8lb shotgun
With various charge weights and 3 ft velocities