

The following article was very kindly sent to me by a customer who is an air rifle enthusiast. He has agreed to share with us all, his method of aligning a riflescope to either a misaligned barrel, or to allow for a "rainbow" type trajectory of an air rifle, or subsonic centrefire. Here is his article. Thank you Don, on behalf of all my newsletter and website readers. Richard Wilhelm.

My excellent and economic scope mounting system.

Or an answer to a question you never dreamed of asking? Read on to see.

I have been playing around with a system of scope mounting that appears to help in quite a few different ways. For all types of airgun. It revolves around using shim stock to better realign scope tubes to barrels.

This of itself is not new, but my ideas start from there and continue on a bit further.

In effect I bed the scope to the mounts.

I also move the scope around as well to help it look in the right direction.

Have you ever wondered about the surfaces that connect the two most important

parts of your shooting iron?

A test can easily be done by you, on mounts set on a rifle, to demonstrate just

how rubbish most scope/mount/receiver match-ups are. Without the saddles/straps

in position simply run a 1.00" (one inch) piece of round steel or brass in the

bottom ring halves (positioned correctly on a rifle) just to get a visual check

on the amount of metal that is taken off. And where it's taken from.

A bit of grit and oil will help here. For little bit, run it backwards and forwards. Just 3 or 4 times then check (Keep a few rags underneath to catch any grit that falls out) - You now know how to lap. It is an eye opener just how 'out' most mount setups are. If you don't want to do the test then you can take it from me that things are less than perfect. What I've found in almost every instance is that very little of the critical contact surfaces are even touched by the metal round and show up very small areas of contact/bright metal this is what you screw your scope down onto. I suspect that most scopes are actually held in place with as little as 10% of contact or maybe a good deal less unless things bend.

Overall benefits of this system :

No moving parts

Cheap to implement - avoids expensive adjustable mount sets

Process fully reversable - no metal removed

Tighter groups from cheaper scopes

Possibly better adjustments on cheaper scopes

Better grip of scope without increased torque on mount fixing screws - springers

Long Range: Full range of clicks gained by controlled positioning of scope and long range distance ability increased by the same factor

Less chance of marking scope from rough interior of scope mounts

Pumpers scope/action integrity aided by the process

Scope internal alignment integrity aided greatly by the process

Invisible - if black epoxy used with black mounts

No softening of barrel metal from bending springer barrels 'to get it right'

Downsides

Takes a bit of time to do

A bit fiddly and messy maybe



Note : This usually affects the rear mount as the airguns rainbow trajectory

normally requires that the rear of the scope be lifted to optimise it's full abilities.

I use an metallic epoxy putty/glue to fill the gaps around the shim thus forming a solid addition to the mount. In effect the scope is glass bedded in the mounts.

Of course the scope has a release agent on it so it can removed after the glue

has set. I use a smear of oil on the scope body and a small square of cling film

over that, covering the tube to isolate it from the glue.

No great forces are used, merely the shim is a spacer until the glue has set.

I would use 8 to 10 inch pounds - hardly any.

This is to insure no bending is introduced into the scope tube.

I think we ask a lot of scopes in general and if we can mount them evenly and

centrally we are doing them a favour. And us too.

This process can be added to over the top of previous efforts with more thin shim

material and epoxy until we get to our required height/thickness, or if we go too

thick we can dig some out and re-do it again.

Cleaning our surfaces in between applications of course.

I suppose it takes a few goes to get the feel of it and I need to repeat it 3 or 4 times to get about the right thickness I want. Sneaking up on it is the way

for me. I started doing this procedure as an answer to scopes that were a poor

match to a gun and would not allow the scope to be zeroed but it has developed

further than that. It can be very precise if you are patient with the process.

It is a bit of a slow process and depends how fussy you want to be.

It's soooo cheap too. A bit of glue, metallic epoxy putty is your biggest expense.

You need a bit of shim but not much at all.

\$1 per airgun or so if you've a few of them.

How it is done is relatively simple:

The scope is zeroed in V blocks to get it to its optical centre.

The gun is put in a gun vice and the mounts are positioned where they are needed.

Then the scope is mounted and the gun shot to see where the scope is looking and

where the gun is shooting. Often in surprisingly different places.

It's at this point where we see where we are going to have to shim the scope.

Using the shim stock (various thicknesses) it's not hard to move the scope round

a bit and start to point it in the direction that the gun is shooting to.

I shim with tiny pieces in the mount claws on the inside of the fixed side for

windage correction -(these are not bedded in) and the height correction is done

by putting shim under the (rear usually) of the scope as it lies in the bottom

of the mount, ready to be torqued down.

Even Weaver mounts can get some side correction with those little bits of shim.

Suitably small pieces can be cut up and bent into the same angle as the sharp

'point' that the scope mount claws fix onto, and put carefully into position under the correct claw to get the adjustment you need.

Regular tip off mounts merely need a very small piece the same size as the inside

of the claw.

I have a selection of shim stock in steel and stainless steel so I use that here,

but as no great pressures are involved you can use bits of plastic packaging,

or tin cans or aluminum cans, to get the right thickness you need.

Shim in the size range of .001" to .005" are usefull for the fine tuning phase.

A set of vernier calipers will be useful here.

I find a a general rule that 3/8" to 1/2" of movement at the target at 25 yds

is gained per thou of shim used. (Use this as a rough guide only)

That is if you use a 4 inch (100mm) spacing between front and back mount when

positioned on the rifle. Sometimes putting the front mount at the back and test firing at this stage gets you closer (scope still centred) and involves less actual shimming. Play around with it to get closer to the ideal position.

Assembly.

Clean surfaces to be glued/bedded. I like to very lightly roughen the areas

to be glued with a bit of sandpaper; just to help adhesion.

At least make sure they are clean and oil free. Lighter fluid perhaps.

You push the cling film coated scope down into the epoxy filled mounts with

the required bits of shim and glue in the right places. These shims are epoxy

coated each side to make sure everything but the scope is glued into place.

(Only use enough to do the job it's not very much)

Then you place the mount topcaps/saddles on and tighten them down.

Again 12 to 18 inch lbs would be fine. Snug if you haven't a torque wrench.

When it pops out after overnight curing there should be a lovely smooth reverse

image of the scope body. Don't worry about reticule being level, at this stage

the scope tube is just a mold or shape. There will be some excess that will

come out the sides but I find it is reasonably easy to trim off with a craft knife afterwards, next day, after things have set.

You could use a piece of 1" round if you don't like the idea of your scope getting that close to epoxy. The assembly stage can be repeated as often as

you want to do it, one layer of shim and epoxy on another until the right height

(usually of the back ring set) is obtained and you're completely happy with your

scope position. The process takes off no metal and is completely reversible.

Digging out unwanted shim might need the mount put in a padded vice so you can

dig away to remove it. However I've hardly ever needed to do it. If, I've gone

a bit too far and the rear is jacked up too much, and I have a higher POI

than

I would like then it's a simple matter of putting a bit of thin shim under the front mount to get the POI back down to where I want it.

Followed of course each time with a bit of epoxy.

It depends on how fussy you want to get.

The beauty of it is that it can be done as many times as you want.

Lapping the top cap is something I thought to be not really needed, but on

thinking more about it, I reckon there are quite a few benefits.

It is about half of the ring clamping force obviously, so there is some reason

to increase actual interior surface contact.

When you fit your scope to a finished lapped bedded mount you notice how neatly

it fits and a small downward pressure on the cap almost locks the scope up with

very little pressure from you. So in the end the scope is going to be very secure from recoil (if present) with less torquing on the cap screws.

For the top cap 70 percent lapped/cleaned up is good enough for me, but it's up

to you how much you clean it up.

There's plenty of metal to clean it up 100% I've found, so don't worry about that.

I've recently finished one set-up and one cap was pretty good in shape but the

other needed so much lapping it took ten times longer merely to get a 70% clean-up. So it's a good thing to do.

Another reason why this is an important mod is the prevalence of cheaper scopes

of the springer rated variety that use a rubber bushing as a rear pivot/bearing

for the erector tube. This bushing strengthens scopes for springer shooting but

the hard rubber makes adjustments away from optical centre a sometimes thing.

Being such a hard rubber the adjusters can't cope very well with pushing the tube

far enough to get a poor match-up of scope and gun to the point where the combo

can work effectively, and get you on target.

I believe a lot of scopes are made with this rubber bush arrangement. One has to feel some sympathy for the scope manufacturers on this point that they were almost forced into it by the big kicker springers that are available today. I have proved to myself that running a scope like this, that is, in the centre of it's adjustment and on target, will give you tighter groups.

A common factor is springers that have some sort of barrel droop either built in or accidental that makes a bit of work for us.

Some lift at the back can help get us into a usable area of scope adjustment.

Maybe not an extreme case like a HW55 that has so much droop (for a match sight)

that this method might not be able to go as far as required. But maybe have a go?

There was at one time a droop compensating Sportsmatch mount for HW springers

that gave at least .012" (0.3 mm) or so hike at the back. Used in conjunction

with this method, extreme cases of droop could be compensated for.



Another area where this process works well is for long range shooting. It's an area where mostly I imagine only fairly good scopes are used, so the effects of centring may be less obvious until you come to the effects of clicking. You want maximum vertical traverse so a centred reticle on at 100 yds is not a bad idea. Some investigation as to click range of the scope may optimize your setup. The closest I ever got was a setup for someone that had the scope centred at 100 metres/109 yds. I got it under 5 clicks away in both directions at 100m and I thought I had done well. I was a bit lucky I think. I could perhaps have put the centred scope on zero at further out, but I didn't know all the scope details, ie. its limit of travel. I assumed he would have had enough to get back down to a 20 or so yard zero if it was needed. He was able IIRC get out to 140 yards or so. The jack up at the back

was over

.020" (0.5mm) a higher than normal rear lift. But it was still entirely doable.

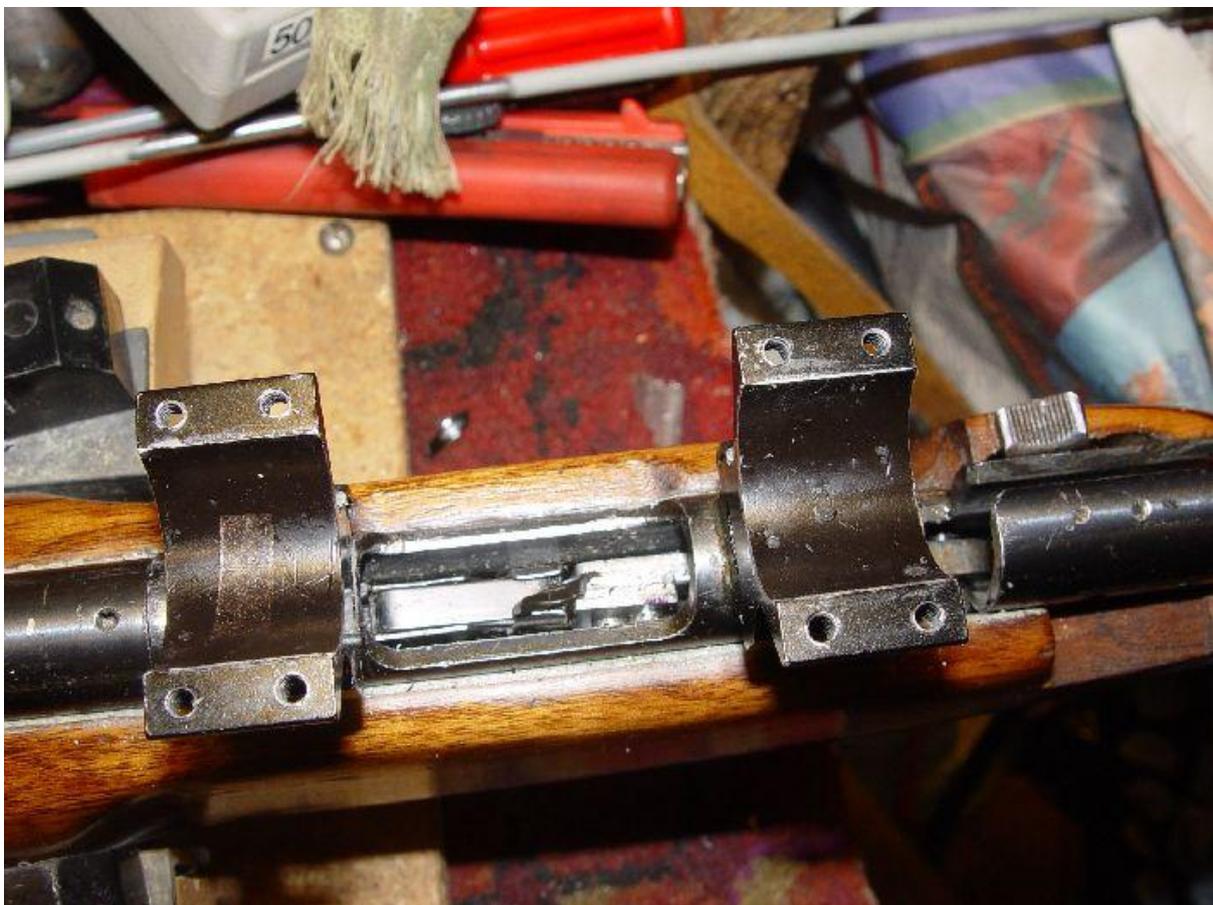
I did a very high rear lift of .030" (3/4 mm) or a bit more on a QB78 that was

set up for long range can shooting. It worked out well using a non standard mildot.

It was a 3-9 Leapers and its big gaps between the non standard dots allowed me have

plenty of drop with the .22 pellets going at 700fps approximately. I could get right

out to 90 or 100 yards and use the big spaced dots above and below the crosshairs.



In the area of pump-ups it also has a beneficial effect.

With most cases pumping involves a downwards pressure on the scope with

consequent pressures going on and off for 10's of thousands of cycles.

This also gives credence to the positive effects of lapping the top strap/saddle

that holds the scope down onto the gun. Any gaps not properly in

contact with the scope tube give room for 'working', or a possibility for flexing/movement during the pumping stage. So a good smooth interior finish to the top cap is good.

Sometimes folks have FFP (front focal plane) scopes that are reticle moving
My system allows setting up of the scope so the reticle appears in the middle as you look through it, negating expensive adjustable mounts.

Cosmetic considerations With a well fitted scope to mount union there is less chance that marking of the scope tube will occur as those high/uneven bits that do the marking will have been smoothed by the process.



One piece mounts are more difficult to adjust sideways for windage but

elevation

adjustments as described above are effectively, the same and as doable as two piece.

To a limited extent as the scope is lifted with the above method so too it can be

moved a little sideways if you think about it. Some shims at the side lifting the

scope and moving it a bit sideways as well can be put in, however the shift you

get is smaller. But it's an option if you must use a one piece mount.

To reiterate benefits again

Cheap to implement -

Process fully reversible -

Tighter groups from cheaper (springer) rated scopes

Possibly better adjustments on cheaper (springer) rated scopes

Better grip scope/mount - springers

Larger range of clicks gained and long range distance ability increased

Less chance of marking scope

Pump-ups scope/action integrity aided

Scope internal alignment integrity aided

Invisible - if black epoxy used

No softening of barrels from bending barrels - (springers)

Downsides

Takes a bit of time

A bit fiddly and messy

PS

An advanced method I've tried involves using two tiny dots (1/8") of rubber at 4 o'clock and 8 o'clock in the bottom mount section stuck in the goop. Use them (in place of the shim) These rubber 'dots' purposely put the scope too high at the back. You actually shoot the rifle with the epoxy still wet and tighten the screws down at the back to achieve your correct scope/barrel position. You take out the rubber bits later or just leave them in. It's a method suited to a precharge or Co2 where there is no real recoil. It's all happening with this method and I've only used it a couple of times. The advantage is of course that you can shoot and adjust, in theory, saving time by losing several steps of the process. With this method you will have previously sorted out any windage corrections with small shim stock. I prefer the first simpler, longer method. It's more relaxing for sure.