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I recently received an interesting email from a gentleman. He was inquiring about the proper way to secure his new reloading press. He had questions concerning the use of studs, metal mounting plates and the proper way to layout a drill pattern. He also wanted to know about drilling & tapping. Often, a person *won't* want all his or her equipment permanently secured to the bench. These are all excellent subjects.

Any number of factors can figure into which are the "best" fasteners to select when equipment & tools are to be secured to a bench. Some of the considerations are: bench size, the number of tools to be mounted, frequency of tool use and weather a tool has holes or slots for fastener attachment. Before we even discuss threaded fasteners; let's look at mounting & tool issues in detail.

Reloading Benches: Benches come in all sizes and materials. Thickness of the bench top plays a big role in how a tool should be mounted. Generally, the thicker a bench top is, the better. A reloading press can generate many tons of pressure. During high stress operations like case forming, a thin bench top, especially one made out of composition or fiberboard can actually break!

Commercial workbench “kits” are available. Usually found in home centers; they are designed for customer assembly. All but the most expensive have some type of composition or fiberboard top. The material itself isn’t a problem, provided it is thick enough. My first bench, built in 1982, had a top made from two pieces of ¾ inch plywood bonded together with wood glue & lots of screws. Plywood, due to its alternating layers, is resilient and can take lots of stress. If a tool is causing **any** flex in a bench top, then it’s time to add another layer of material to the top, no ifs, ands or buts. The last thing you want is to wind up with a press crashing into your lap or foot!

The best bench tops are made from thick sections of solid wood joined together with a combination of rods (steel or wood) & a bonding agent. This style bench top is very heavy and won’t flex.

Tool Configuration: Some loading tool mounting flanges have slots others have holes. My Redding Ultramag 700 press has 4 slots. When a tool has **slots**, then the correct fastener (on a wood bench) is a **carriage bolt**. Carriage bolts have a smooth rounded head and a square section directly underneath, followed by the threaded section. The square section mates into the slot on the presses mounting flange. When carriage bolts are utilized; washers, lock washers & nuts are only required on one end. When a tool has **holes** in the mounting flange, then either machine screws or possibly studs are the proper fasteners. We’ll talk more about these various fasteners later.

Number Of Tools & How Tools Are Used: Bench length, the number of tools required, the amount of stress a tool develops during use, and the frequency of tool use will also determine what fastener to use.

The reloading press gets plenty of use and develops *tons* of pressure. A reloading press needs solid, secure mounting with the proper diameter fastener its mounting flange is designed for. Since the press is usually the most often used tool on the bench, it is almost always permanently bolted to the bench. For a right-handed person, it is usually mounted somewhere near the right hand side of the bench. Since my Redding Ultramag 700 press has 4 mounting slots, 4 **carriage bolts** secure it to the wood bench. Under the bottom of the bench, 4 **fender washers, lock washers & nuts** are used (Note 1). **Fender washers** are larger in area then standard size washers. The larger the area, the more the pressure is spread out when the nuts are tightened.

Now let’s suppose we had a press like the Lyman Crusher, and we were mounting it to a wood bench The older Lyman Orange Crusher had 3 slots. It would be mounted with 3 carriage bolts installed from the top of the bench. The updated Lyman Crusher has mounting **holes** instead of slots. We would also use **carriage bolts** to secure it to the wood bench, *except* we would put the bolts in from the *bottom* of the bench. Then, we would slide the press over the threaded portion of the carriage bolts that are sticking up thru the bench. Since we are going to tighten the nuts against the metal press flange, we won’t need the wide fender washers. **Regular sized flat washers; lock washers & nuts** will finish up the job. The two preceding paragraphs cover a *permanent mounting* of a tool that imparts a *high amount of stress* during operation.

What about equipment that isn’t used all the time and you don’t want it permanently mounted, or when equipment doesn't require as strong a mount as bolts thru the bench? What if a bench is very small, and tools can only be mounted one at a time?

For tools that impart very low stress, items like powder measures and case trimmers; I secure the tools to woodblocks with carriage bolts, and C clamp the blocks to the bench when using the tools.

For *non-permanent* mounting of a tool that imparts a *high amount of stress* during operation, like a reloading press or a bullet lubricator / sizer, then stronger medicine is required.

None of the companies producing reloading tools see fit to supply a drilling template with their products. That's OK, what we are going to do in this article is *accurately* measure the bolt pattern of a reloading press, create a print and transfer that data to a steel plate. Then we will D&T (drill & tap) the plate and correctly secure the press to the plate. First though, let's look at some of the hardware and tools we will need.

Notice the square section behind the head of this carriage bolt. It will catch in the slot on a press flange or in a block of wood.

Nut, lock washer, flat washer & stud. The stud is 5/16-inch diameter, 2/34 inch long. Notice the base

portion of the stud (that part that will be in the plate) is coarse thread 5/16-18, then there is a unthreaded part, the upper part fine thread 5/16-24. This is known as a “double ended stud”.

Regular washer on left, fender washer on right, fender washers are best when tightening against wood.

Machine bolt & nut.

C Clamps are great for temporarily clamping tools in place, but *only* if the tool is already secured to a wood or metal. Clamping directly on a tools surface is *bad* business!

What we'll need to get started.

Caliper: Every reloader has, or should have a caliper. Dial calipers are fine, digital calipers are a bit faster to read. A caliper is one of the most versatile tools available. Utilizing the inside, outside and depth features, almost any measurement can be taken, or the tool utilized to adjust another measuring tool. During the construction of this mounting plate, we will use all 3 features.

Every web-based supplier of reloading tools carries calipers. The least expensive source of calipers is Harbor Freight & Tools, **www.harborfreight.com**.

Tape measure: A plain inch tape measure is fine, however a machinist's tape measure is better. A machinist's tape measure has both inched and mm (millimeter) scales. For measuring long distances, the mm scale is actually better. A machinist's tape measure can be acquired from any industrial tool supplier.

Carbide tipped scribe: To make an accurate transfer from the print to steel, fine lines are required. A carbide tipped scribe will put a *very fine* line in cold-rolled steel. A carbide tipped scribe can be acquired from the tool department of any home center.

Sliding Square: Any good, *all metal* sliding square will work. A sliding square that is all or part plastic is fine for woodworking. However, Plastic squares won't cut it for accurate metal work. An all-metal sliding square can be acquired from the tool department of any home center.

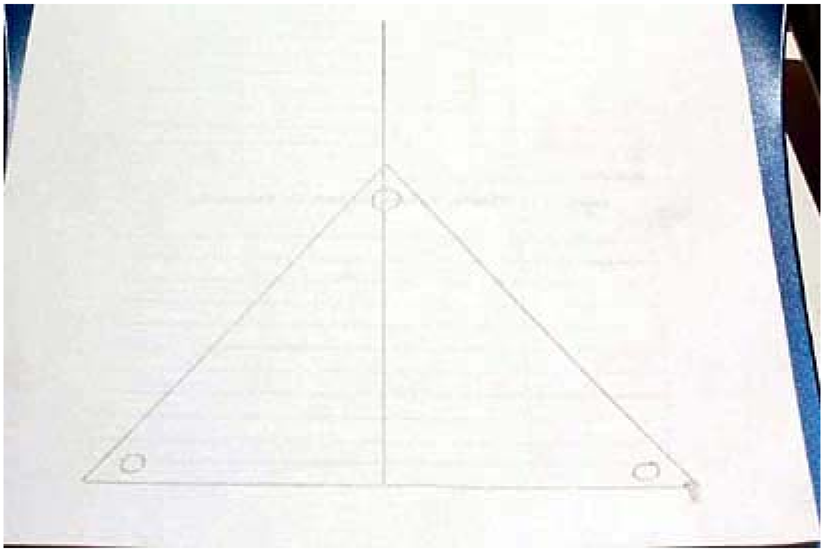
Center punch: To accurately drill holes in steel, the exact place you want the hole must be center punched, so the bit has a place to start cutting. Most drill bit kits have a center punch included. Center punch's & drill bit kits can be acquired from the tool department of any home center, a department store or Harbor Freight & Tool.

Ball peen hammer: Any hammer will work to drive the center punch into the steel.

Tap, tap handle & tapping fluid: These items kits can be acquired from the tool department of any home center, a department store with a good tool section, like Sears or Harbor Freight & Tool.

Paper, pencil, ruler & calculator: These items will be used to make the print.

First we establish a centerline on the paper.



Now a simple sketch is drawn. As we gather information in the next steps, the various distances will get filled in. The line at the very bottom that runs left & right is known as the "Datum Line" (Note 2).

Measuring the width of the holes with the inside jaws.

Even though all 3 holes are the "same" size, it's best to measure all 3 of them and take an average. Don't be surprised if they vary by a .002 or .003. In this case the average size of the 3 holes is .326. Half that distance is .162. Both these dimensions are very important. When laying out a drill pattern, all measurements have to start from one central point, usually known at the "datum line". In this case the datum line is that point where the press frame abuts against the bench, all measurements will start from that point.

Measuring center-to-center distance of inboard holes.

The outside caliper jaws will so be used for this measurement. I simply measured the distance between the inside edges of the two lower holes. I recorded this measurement, 3.686 inches. Next I *added* the entire diameter of one hole 0.326 inches.

3.686 Distance between the inside edges of the two lower holes
+ 0.326 Diameter of one hole

4.012 inches = Center-to-center distance of inboard holes (this measurement will be

transferred to the steel plate).

Measuring from datum line outboard hole.

The inside jaws are the best ones to use for this measurement. I ran into a challenge right away. The lip of the press frame is too large to allow the tip of the inside jaw to engage the farthest hole from the datum line *and* rest flat on the press frame. What I did was press one ***side*** of my sliding square *firmly* against the point on the press frame I established for the datum line. This gave me a surface the caliper could work with. I set one inside jaw against the edge of the sliding square, and the other inside jaw of my caliper against the far edge of the hole. I recorded this measurement 2.370 inches. Next I *added* the *width* of the sliding square 1.008 inches. Lastly I *subtracted* ½ the width of the hole (.162 inches) from that total.

2.370 Edge of square (pressed to datum line) to farthest edge of outboard hole
+ 1.008 Width of sliding square

3.378 Total length
- 0.163 ½ diameter of hole

3.215 inches = Distance from datum line to center of hole (this measurement will be

transferred to the steel plate).

Checking width of square.

Measuring from datum line to center of inboard holes.

The inside caliper jaws will also be used for this measurement. Once again, we have to get a bit creative in taking this measurement due to the lip of the press frame. This time I pressed the ***edge*** of my sliding square *firmly* against the point on the press frame I established for the datum line. I set one inside jaw against the edge of the sliding square, and the other inside jaw of my caliper against the far edge of one of the inboard holes. I recorded this measurement, .448 inches. Next I *added* the edge diameter of the sliding square, 0.084 inches. Lastly I *subtracted* ½ the width of the hole (.162).

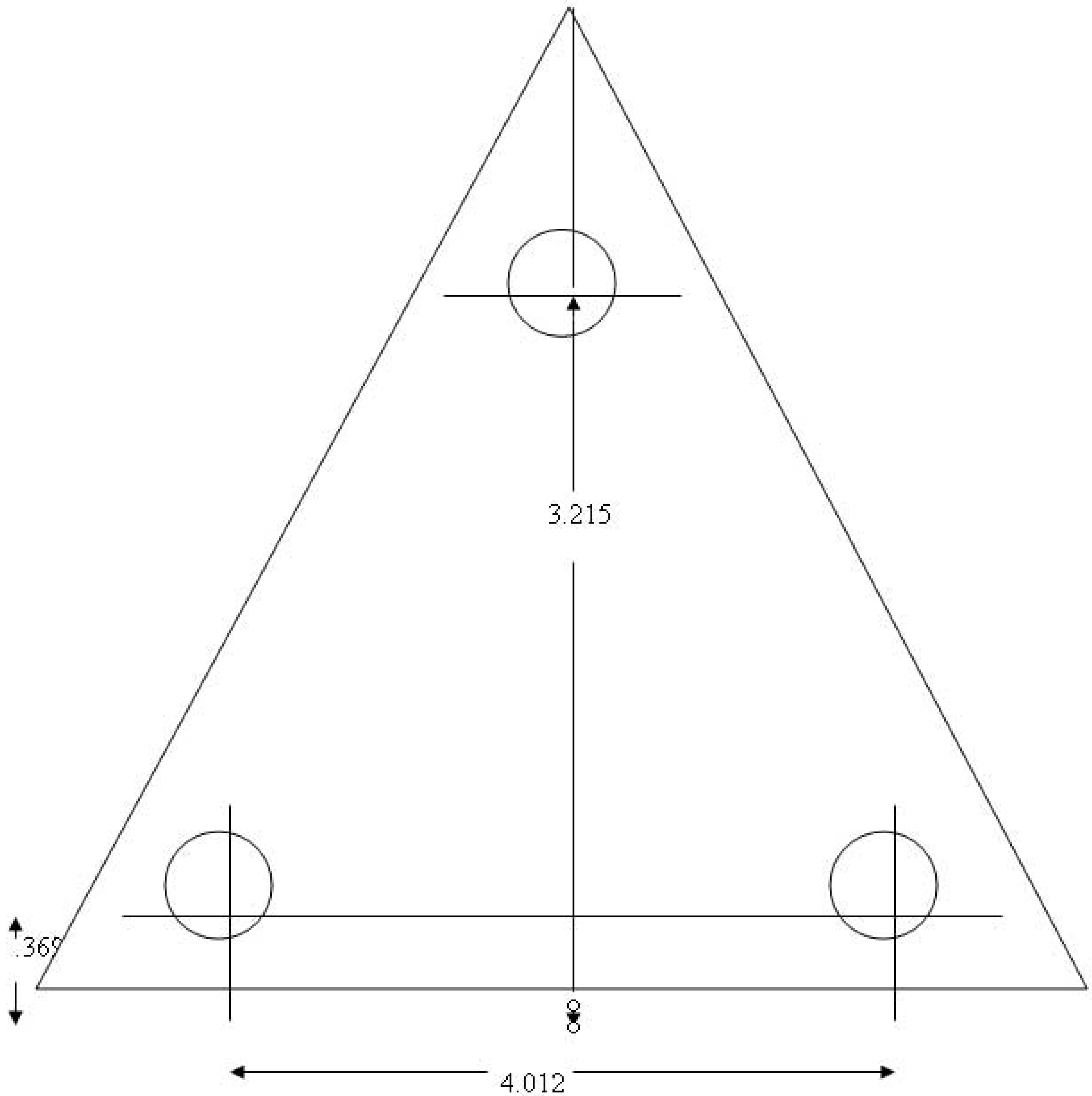
.448 Side of square (pressed against datum line) to farthest edge of inboard hole
+ .084 Height of sliding square

.532 Total length
- .163 ½ diameter of hole

.369 = Distance from datum line to center of hole (this measurement will be

transferred to the steel plate).

Measuring the height of the square.



Finished print.

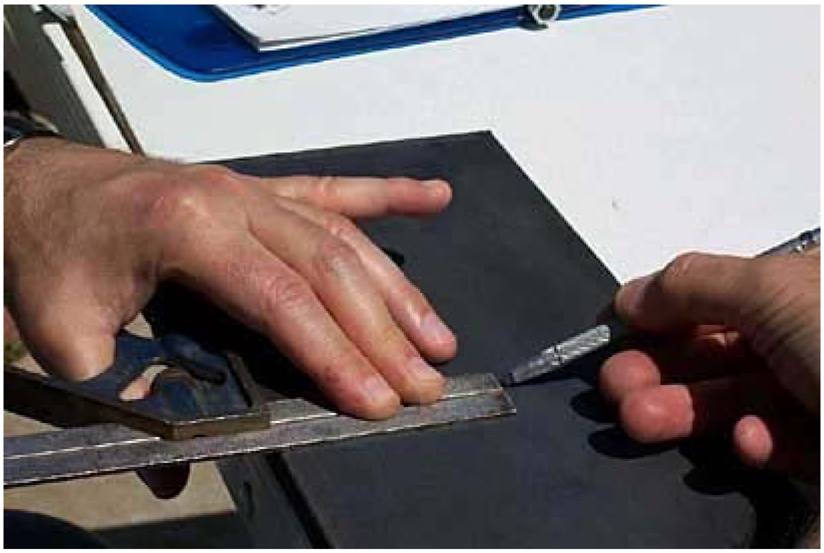
Measuring the centerline & vertical or Y-axis of the outboard hole.

This is where a mm tape measure pays for itself. Measuring long distances is easier when all you have to do is count in hundreds. The steel plate measures 786 mm's. Simply divide by two, and we know the centerline & outboard hole Y-axis must be 393 mm's. At the 393 mm point of the tape measure, a small line is carefully marked in the steel. Then the sliding square& Scribe are used to carefully scribe a line bisecting the entire steel plate at the point that was previously marked. This line is the centerline.

Scribing the centerline & vertical or Y-axis of the outboard hole.

Using the caliper to set the sliding square for scribing the horizontal outboard hole.

The depth feature of the caliper will be used for setting the sliding square so we can scribe these lines on our steel plate. Previously, we established the distance from the datum line to the horizontal center of the outboard hole as 3.215. The caliper is set at 3.215. The depth part of the caliper is used to carefully adjust the sliding square. Once the square is adjusted and tightened down, loosen the caliper and recheck the sliding square. Don't be surprised if the square has moved a few thousands in the process of being tightened down. If it has, simply tap the end of the square on a block of wood and recheck it with the caliper. Once the caliper is set exactly, scribe the horizontal line. Do the same procedure for the inboard holes.



Scribing the line for the horizontal or X-axis outboard hole.

Marking the vertical or Y-axis center-to-center measurement of the left inboard hole.

Marking the vertical or Y-axis center-to-center measurement of the right inboard hole.

The outside caliper jaws will be used for moving this measurement from our print to the steel plate. It has been established the total center-to-center distance of the inboard holes is 4.012 inches. That means each hole will be ½ that distance (2.006 inches) from our centerline. The caliper is set & locked at 2.006 inches. The point of one outside jaw is set exactly in the centerline and a small line carefully marked in the steel by the other outside jaw. Reverse the caliper to the other side of the centerline and carefully mark another small line. The sliding square and scribe are used to turn the two small marked lines into scribe marks.

Scribing the line for the vertical or Y-axis center-to-center measurement of right inboard hole.

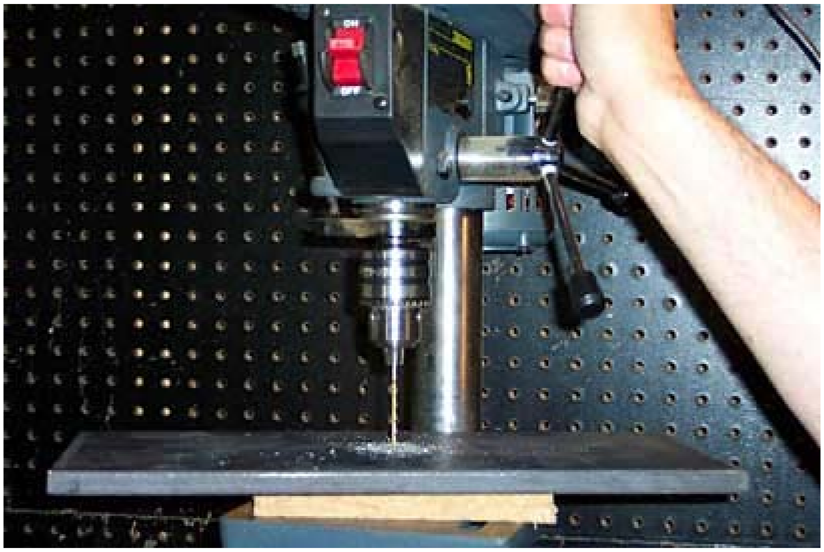
Scribing the line for the vertical or Y-axis center-to-center measurement of left inboard hole.

Using the caliper to set the sliding square for scribing the horizontal inboard holes.

Scribing the line for the horizontal inboard holes.

Center punching the steel plate.

The *exact point* where the X & Y axis lines meet must be center punched for a drill bit to start straight without “walking”. I generally make a tiny punch mark, then check it again with the caliper to make sure it’s exactly center before striking again.



Drilling the holes. Start with a 1/8-inch drill bit & work up to the finished size in steps. The piece of scrap wood lets me know when I'm through the plate. As soon as I see wood dust come up through the plate, that hole is done.

Once all 3 holes are center punched, it's time to drill the plate. Since we are going to tap the holes 5/16-18 NC thread, we need to know what size drill bit is required for that tap size. Referring to the Starrett Drill / Tap Cart, we see they recommend an "F" bit, that's .257. The secret to getting a hole drilled exactly where you want it is to first have the spot center punched, then start with a very small drill bit and work up thru successive steps, each one being larger then the next. This series of bits makes for straighter, smoother holes and strains your drill press or hand drill less. This really helps if an electric drill is a low power unit. The next-to-final bit should be just slightly under the finish size. This way the finish bit will just clean up the hole, leaving a nice smooth & straight surface for the tap.

Tapping fluid, tap & tap handle, Drill & tap card, level.

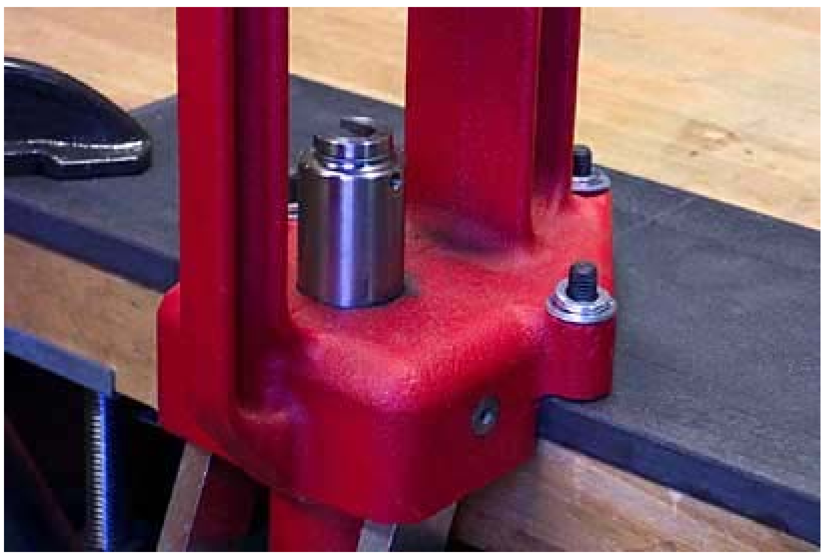
Tapping holes requires 4 things. The surface to be tapped must be held rigid & level. I clamped the plate in a vice and checked it with a level. Alternately, the plate could have been C clamped to the bench. The tap & tap handle must be held straight. The tap will have a natural tendency to follow the hole, but it can get cocked off center a bit if the operator isn't careful. The tap must be backed up frequently to clear chips. I make a ¼ turn forward, then reverse the tap ¾ of a turn to clear chips. The last thing required is tapping fluid. Tapping fluid can be acquired from any home center, hardware or tool store. I use Tap Magic, however, any quality tapping fluid will work. After the holes are tapped, flush the holes with a spray cleaner. The spray cleaner will clear out any remaining bits of metal or tapping fluid.

Turning studs in with locking pliers.

All that's required to seat the studs is a pair of locking pliers. Hold the stud by the center unthreaded portion and turn it in tight.

Finished plate C clamped to bench. Look carefully and you can see the scribed lines in the plate.

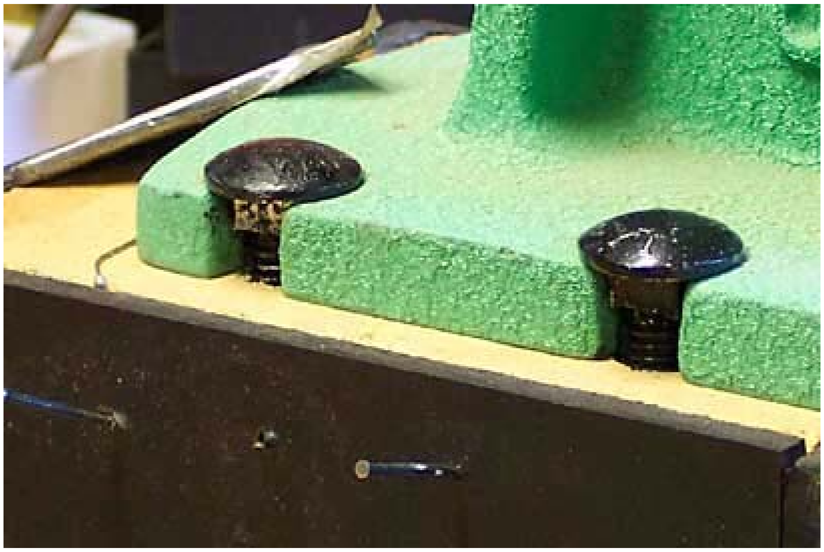
Press slid into place.



Flat washers & lock washers installed.

Tightening down the nuts.

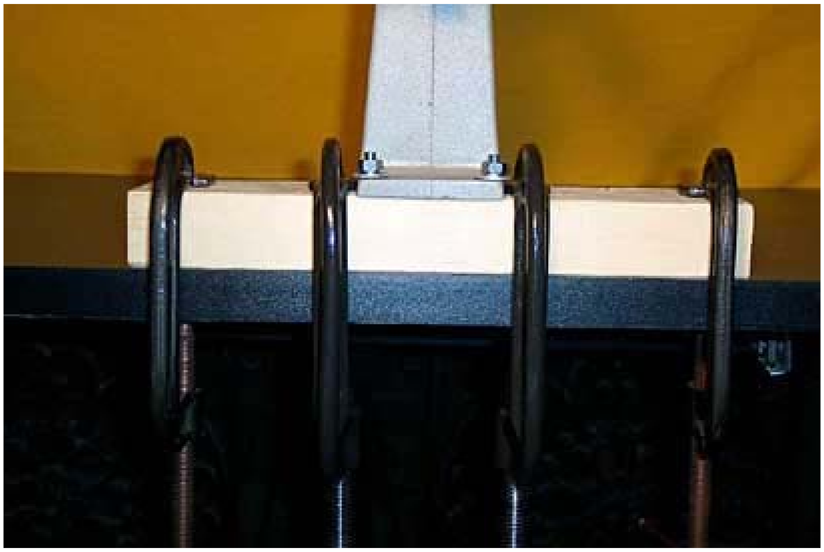
Finished!



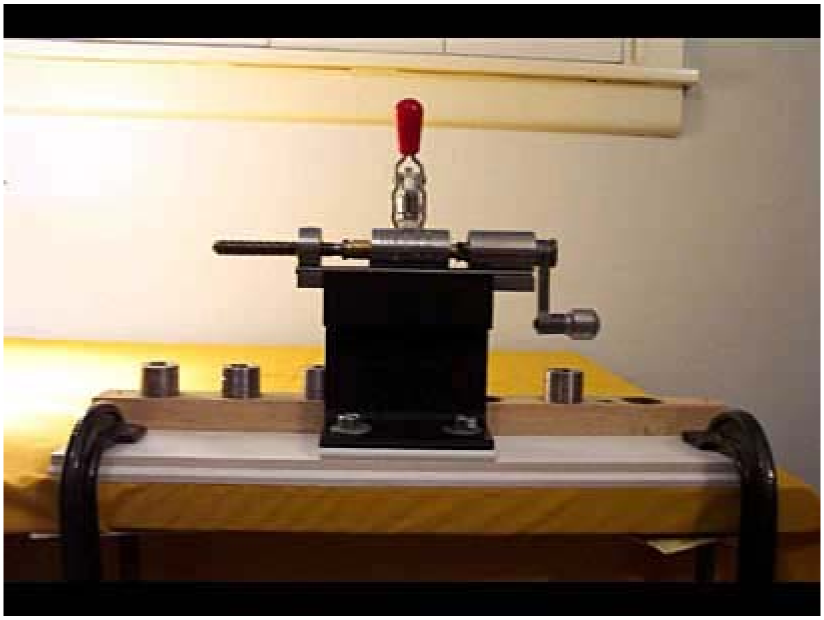
Carriage bolts fit into slotted press flanges.

I have way to many powder measures to be permanently mounted to the bench. I secure them to

pieces of 2X4 with carriage bolts. The carriage bolts are countersunk in from the *bottom* of the blocks.



Flat washers, lock washers, nuts and 4, count 'em 4 C clamps. Secured to a loading bench like this, guarantees it's not moving!



Case trimmer secured to wood base by countersunk carriage bolts installed from the bottom of wood base. Wood base secured to work surface by C clamps.

Carriage bolts are countersunk into the bottom of mounting blocks.

The techniques we've discussed in this article will come in handy in a lot more places then just the loading bench. Knowing how to make an accurate print is easy, and takes little time. The simple steps outlined here will allow any piece of equipment to be properly secured to any work surface.

Note 1
All the hardware discussed in this article, studs, carriage bolts, machine screws, fender washers, flat washers, lock washers & nuts can be acquired from any well stocked home center or hardware store. They have bins with various lengths, thickness & different thread items. Chances are they will have exactly what's required for your particular application Department stores carry a small amount of general use hardware. *If* they happen to have exactly what you require, count it to luck!

Note 2
According to Mr. Webster: Datum line: The horizontal or base line, from which the heights of points are reckoned or measured.

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