Top Contact, Back Contact Binding Posts & Top Contact Screw.

The binding posts are where the coil/capacitor wires attach to the machine. The back binding post is also where the clipcord attaches the machine to the power supply, one end of the two hooked prongs of the clipcord hooked into the end of the binding post (on a vertical post set up) or into a small hole drilled into the shaft of the binding post (on a horizontal post set up). The other hooked end of the clipcord hooks into a small hole drilled into the underside of the machine frame spring saddle, just to the outside of the armature bar securing screw hole.
The top contact also holds the contact screw. This is an important little screw! They should be made from a good conductive material. Sterling silver is preferable, but brass & copper are good, too, although copper can be a little soft & can mushroom. Steel will work but isn't recommended. It will run very hot & holes burned right through the front spring will be the result!
When operating, a machine undergoes friction in several areas; the most obvious is where the contact screw connects with the tip of the front spring. A groove in the front spring may appear over time in the area where the spring connects with the contact screw. This is normal wear & tear but the time it takes it takes to develop varies according to the material the contact screw is made from. It's important to keep an eye on contact screw/spring wear.

A back contact binding post, hexagonal horizontal fitting & round vertical fitting.

A top contact binding post with a contact screw, hexagonal & round.

Contact screws

The point where the contact screw makes contact on the front spring will change a machines performance. It's an important co-factor in the setting & adjusting of the distance the armature bar will travel (the stroke), by, among other things, acting as a limiter for the front spring, so it must be tightened or loosened in conjunction with the tension on the springs.
Tightening the contact screw will lessen the distance the armature bar will travel & increase the speed of its movement. Changing the angle of contact will also make a difference.
Pivoting the contact screw to make contact farther back on the front spring will reduce the distance the armature will travel even more, shortening the stroke, increasing the tension put on the front spring resulting in a machine that just won't run.
Tightening the contact screw or moving the contact screw's point of contact back without adjusting the spring tension will retard the function of the machine in the same way.

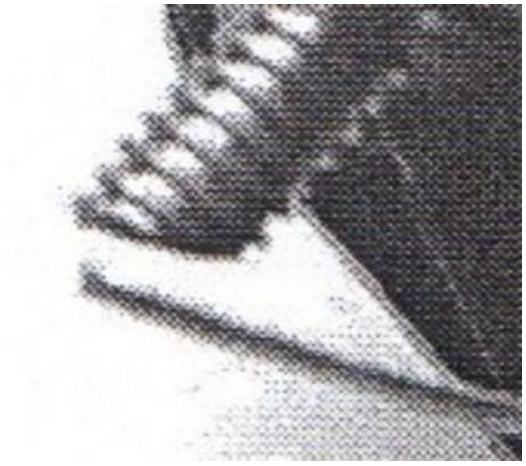
Shortening the stroke lessens the distance the needles will protrude from the tip of the tube & in effect may limit potential needle penetration…solid colour needs more needle penetration than shading, but the stroke should be the same for either application.
Another result of a compromised stroke by tightening the contact screw is the versatility of the machine.

A machine that can shade smoothly needs flex in the front spring. When the screw is tightened, it pushes down on the front spring, decreasing the flex margin the spring already has & increasing the upward tension against the contact screw. A machine with this much tension will not shade smoothly.
Shortening the front spring & moving the contact screw's contact point farther back on the front spring will do the same…increase tension & reduce stroke.
Loosening the contact screw will do the opposite; a longer stroke will require more tension on the rear spring to compensate for the distance the armature bar will travel.
So you can see that needle depth is crucial & can't be sacrificed when making adjustments of the contact screw. The less needle that penetrates, the lighter the colour will be & the lighter the line will be.

A lot of tattooists like to add things like little skulls, dice etc., to the top of the contact screw. This is fine as long as they are attached well, otherwise you'll get vibration that can move the screw slightly, upsetting your setting!

'Dice' decorated contact screw, this one is a 6/32 size.

It’s a common myth that the contact should have a ‘flat’, angled to the spring bend, end. If the screw end is at an angle, like this….



you won’t be able to turn the screw to achieve fine tuning, so if you turn the screw, even just a half turn, you get this…

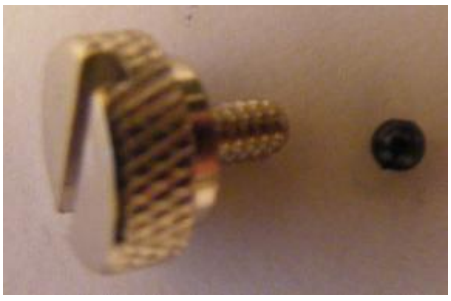
Which is no use at all!

Some machine top binding posts are threaded for a 6/32 screw, others for an 8/32 screw, yet others for a metric screw.

It's worth taking a moment to get a bit of an idea of screw threads. An 8/32 screw does not mean 8/32nd of an inch; it's not the measurement on a ruler. The numbers are used to actually describe the screw, 6/32, 8/32 etc., the first number indicates the size of the screw's diameter, or inside diameter for it's corresponding washer, so an #8 washer will fit an #8 screw….the second number is the number of threads per inch the particular screw has….so our 8/32 contact screw is a size 8 with 32 threads per inch, & so on.
I know it's common to reach for whatever screw looks like it'll fit & trying to force a metric screw into an imperial thread & vice versa, stripping the threads of the screw & the hole it's being forced in to. As most binding posts etc., are brass & therefore pretty soft, it's soon buggered! That's why it's useful to have an understanding of these numbers.
With the contact screw in place in the top binding post, a locking screw is needed to keep the contact screw from moving once its desired position has been set. It's important that its threads are not damaged as this will limit any further adjustment. Also, metal to metal contact isn't really desirable here. Nylon screws are available for this job. If you have to use a metal screw as a lock screw, use a small plastic bead inside the binding post, between the contact screw threads & the lock screw.
It's not actually necessary to use a contact 'screw'. A piece of brass rod will do the job, providing that it fits snugly in the hole in the binding post. A 'thread protector' isn't necessary here, but I still advocate no metal to metal contact with the lock screw & the use of the little plastic bead.

Nylon lock screws.

Metal lock screw & little plastic bead.



Carbon build up is common on the contact surface of the contact screw, so occasional filing or light sanding of the tip of the screw to remove the carbon build up is needed, but only remove the carbon build up, try not to remove too much metal from the screw,

otherwise you'll need to re tune the machine.
The more surface contact, the better the function, the longer the life of the front spring, the better the performance of the machine. So the more surface contact between the contact screw & the front spring the better, without flattening the screw as in the pix above, a well rounded screw end is ideal.

There is another way of connecting the machine to the power supply other than the standard clipcord & that's an RCA jack & socket fitted to the machine. This socket is wired up to the back binding post. The benefit of one of these is that the connection is pretty solid, it doesn't flop about like a clipcord & there is no carbon build up that can occur on the 'prongs' of a clipcord & the hole in the spring saddle. This carbon build up causes erratic running & needs filling off the clipcord (a small drill bit is handy for de-carbonising the spring saddle hole). Also, as the clipcord swings from side to side, it will wear the out the soft brass of the back binding post.
Another benefit is that with an RCA socket fitted on its bracket to the machine, you can still use a standard clipcord on the machine, should you require.

A standard clipcord for attaching machine to power supply.

An RCA socket & bracket, it's simply bolted to the machine by the back spring securing screw & connected to the back binding post.

An RCA socket & bracket attached to a machine.

A ‘worn out’ back binding post, caused by the side to side movement of a clipcord in daily use.

Screwing It All Together.

So assuming you have a machine ‘kit’ or you’ve ‘inherited’ a machine that had to come completely to bits….now it’s all got to go back together….& run!

A random pile of bits!

First off, get all your bits & pieces in a logical order, making sure you have ALL the required parts….& the right tools, too!

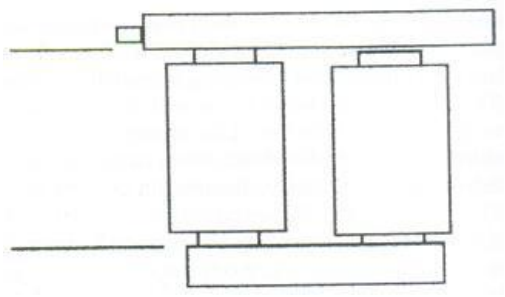
There is going to be some assembling & disassembling of the same parts to get this bit right.
Starting with the armature bar, screw the spring securing screw in & attach just the back spring at this point, do the screw up just enough to secure the back spring, don't crank down hard on it, it's coming apart again in a bit!

Now attach the coils to the frame. Again, don't do the screws up real tight just now, just tight enough to seat the coils in position.

Attach the armature bar/back spring to the spring saddle, lining it up straight over the coil

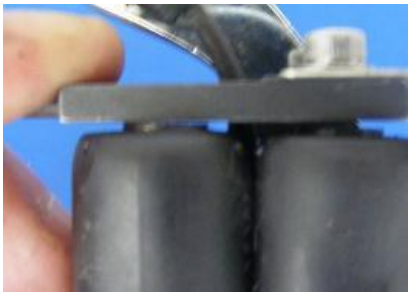
tops. Do this up just tight enough too, yep, it's coming off again soon!

Holding the machine so you're looking at the left side of it (the 'open' side, opposite the sideplate/arm…unless you have a left handed machine, yep, you can get 'em!) depress the armature bar 'till it's pushed down square on the FRONT coil top. It should be perfectly straight & perpendicular to the frame's base plate.

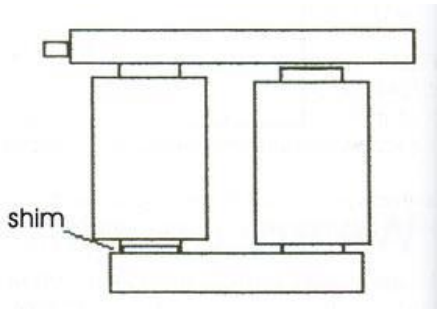


If it deflects downwards even the slightest bit, you're going to have to shim up the front coil. Same deal if it touches BOTH coil tops, it doesn't want to be touching the back coil.

The front coil here needs shimming, it has to sit slightly higher than the rear coil.



Remove the armature/back spring & undo the front coil screw. You should have a selection of steel shims, this is a fiddly bit… aided by a pair of tweezers. Lift the front coil a bit & have the coil screw just showing through the frame a few threads, using the tweezers, pop the shims over the screw then push it up through the frame so the shims don't all fall off! Screw the front coil up & re attach the armature bar/rear spring & repeat the above procedure. Keep shimming 'till you get it spot on…near enough is NOT good enough!

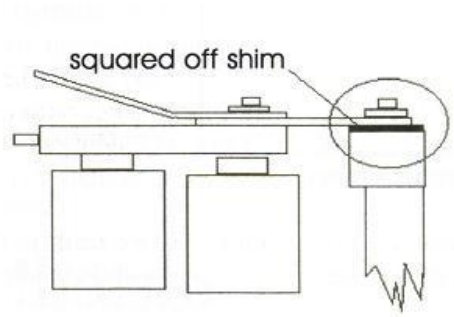


Then with the armature bar pressed down on the front coil, look at it from the front of the machine, checking the bar sits flat & square to the top of the coil….

If it's not, see what's making it skew, a twisted or 'torqued' back spring, an out of alignment coil, an un level coil top, a twisted armature bar or a bent frame.
Sort whatever it is at this stage before going any further! A bent frame will be the worst of these problems for you!
Once you have it right, secure the coils, but don't really crank down those screws yet, just nicely bedded down.
Now check the armature bar alignment against the top of the front coil again, just to be sure.

If the armature bar deflects UPWARDS, i.e., hit's the top of the front coil before it's in a horizontal position…

you're going to have to use a spacer under the back spring. Use a square steel spacer the same size as the width (front to back) of the spring saddle/back spring.



Then go through the coil height routine again…the front coil will need shimming to give it a slightly higher profile to the rear.

Once you have it all at the right height, remove the armature bar/back spring & put it to one side.

You need to find a space for the capacitor now. If you have a 'sideplate' style frame with a biggish central 'hole' in it, the capacitor might well sit in here, nestled between the coils. All being well, the capacitor leads will reach both top & back binding posts!

Capacitor placements.

Loosen the coils again so you can tip them sideways a little & place the capacitor where you want it & do the coil screws up again. Check the capacitor isn't being squashed or any of its wires, or the coil wires, anywhere. If it's all good…do the coil screws up good & tight now.
Different styles of frame will require varying capacitor placements …at the side of the side arm, to the front of the coils, at the back of the coils, etc.

Take up the back binding post & take it all to bits. You should have the post itself, the

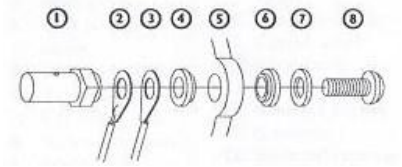
securing screw, two plastic insulating shoulder washers & a couple of steel washers.

Back contact component parts.

On a sideplate style frame, hold the machine with the back of the machine towards you, pop a steel washer & then a plastic insulating washer on the screw & place it in the back contact hole in the frame, then on goes the other plastic insulating washer, a steel washer, the soldered lug from the back coil, the soldered lug from the capacitor & another steel washer. Depending on the neatness of the soldering/thickness of the insulation on the lugs, you might well need a washer between them, too.

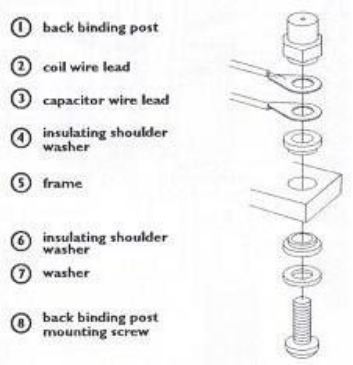
Do it all up nice & tight (but don't be apelike with it!). You'll probably find the binding post spins around as you do the screw up…hold it with (decent pliers…pad the jaws). The little hole in the post needs to be pointing upwards, facing the little hole in the underside of the spring saddle. Otherwise your clipcord won't have anywhere to clip in to!

Diagram for horizontal back contact fitment.



For a vertical back contact post it's a similar deal…

Diagram for vertical back contact fitment.



Horizontal back contact correctly fitted to machine.

The only time your going to have a sight problem is if the fitment on your frame fits horizontal through the rear upright of the frame….in that case, fit the binding post BEFORE the rear coil….otherwise you wont be able to get to the screw head….it'll be 'hidden' by the rear coil! It'll take a bit of juggling with the coil/wires/capacitor etc., like the machine in the picture below.

Example of a difficult to get at back contact screw.

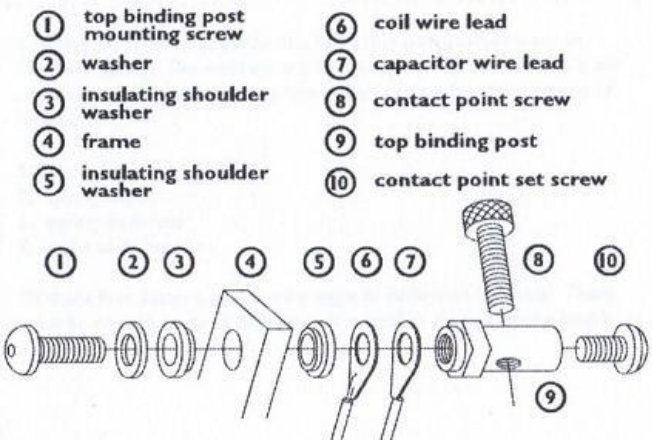
Now do the same procedure with the top binding post. Remove the contact screw from it first.

Top contact component parts.

Pop a steel washer then a plastic, shouldered insulating washer on the screw & insert it through the top contact hole in the machine frame, followed by another plastic insulting washer, steel washer, front coil wire lug (maybe another washer), capacitor wire lug & another steel washer. DON'T do it all up real tight at the moment.

Top contact fitted to machine without contact screw. The use of padded jaw pliers will prevent the damage to the plating evident on the binding post in this picture!

Diagram of how a top contact goes together on the machine.



You can space out the top binding post from the frame with steel washers/shims to ensure the contact screw is positioned dead central to the middle of the front spring.

Turn your attention back to the armature bar/springs again.
Fit both springs to the bar, back spring first, then front spring on top of it with nothing in between them. Keeping it all lined up straight, do the securing screw up…not too tight, but tight enough so the whole assembly won't flop around. Remember, big washer on the springs & smaller washer on top of that to spread the load.

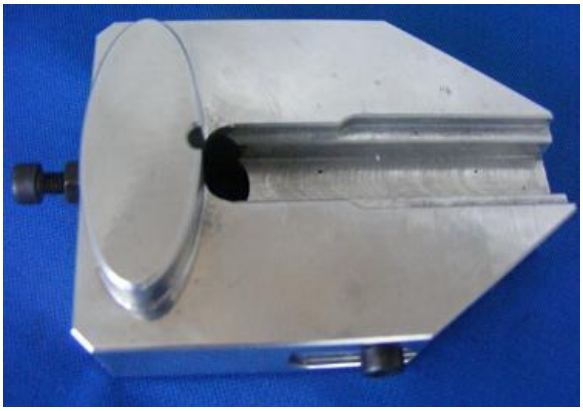
Fit the whole caboodle to the machine at the spring saddle.
Unless you have had to use a spacer to raise spring saddle height, there should be nothing between the back spring & spring saddle. There should be a substantial washer on TOP of the back spring…I prefer a big 'D' washer, which is exactly what it says it is! The flat of the 'D' ideally in line with any bend in the back spring…unlike in the photo! If your spring saddle is machined with an angle precluding the need for a bend in the spring, then whatever way looks best to you will be fine…just like in the photo! Of course, you don't have to use 'D' washers, ordinary round ones will do the job just fine too!

Brass 'D' washer.

‘D’ washer positions on back spring.

If you want to use a drilled out coin or foreign coin with a hole already in it as a big washer, to ‘pretty up’ your machine, make sure to file/grind flat the side of the coin that will sit on the back spring, otherwise you’ll get vibration.
Again, don’t do the securing screw up real tight for the moment.
Now, line everything up nice & straight, making sure the pin of the armature bar is central over the tube vice of the frame. (ideally, just to the rear of central).
Once you have it all straight, carefully remove the armature bar/spring assembly off the machine again & (really handy if you have one) use the useful little tool to hold the armature bar/springs straight & do the securing screw up TIGHT.
If you don’t have the useful little tool, the armature bar/springs WILL skew out of alignment….& it’s a real pain!
Pop the whole assembly back on the machine & (again, really handy if you have one) use an armature bar alignment tool to position the bar properly (do the tube vice up with the tool in place) & do the back spring securing screw up nice & tight now.
Remove the armature bar alignment tool!
Place a rubber ‘O’ ring under the front spring & loop it over the spring securing screw.

The handy armature bar/spring alignment tool.



And the tool in use.

The armature bar alignment tool.

And the tool in use.

Now screw the contact screw into the top binding post, adjusting the whole post so the contact screw is touching the spring just a millimetre or two from the edge of the front of

the front spring.
Do the binding post up tight now (using the padded jaw pliers again).
Set your contact gap by adjusting the contact screw in or out as required & lock the contact screw with the nylon lock screw.
If you're using a metal lock screw, don't forget the plastic bead between contact screw/lock screw.
Hook it up to the power supply with a clipcord, stamp on the footswitch….. & your machine should run quite well with a bit of adjustment of the contact screw.
Don't worry about fine tuning just yet…that comes in the next part!

If it runs…well done!
If it doesn't…..what's gone wrong?!

Firstly, did you get a 'click' when hitting the footswitch & the armature bar went down & 'stuck' to the coil?
If so, you have a closed circuit.
This happens when a coil wire, soldering lug or capacitor wire is making contact with the frame.
So too, if the back/top binding posts are not insulated from the frame.

Check the binding posts first. It's not uncommon to mix up the order of the steel washers & plastic insulated washers…we've all done it at some point!
Then check the soldering lugs are not making contact with the frame at all.
Then check ALL the wiring, somewhere, an un-insulated wire is making contact with the frame.
Check that you haven't squashed a coil wire/capacitor wire against the frame when you screwed the coils up tight, especially if the capacitor was a tight fit between the frame/coils etc., if it's not readily apparent, take the whole thing apart again & carefully check all the wiring as you go.
One other thing….if you have a non ferrous frame (plastic, aluminium etc)…did you remember to fit a ferrous yoke?
No?….Doh!

Did the machine not run at all….just dead?
First check your clipcord/footswitch/power supply. If it all works on other machines, or on a multimeter, check your contact screw & front spring, any shit here will stop your machine dead!
Clean the contacts with electrical contact cleaner.
You might have a wire break. This can happen at several places on your machine.
At the soldering lugs is favourite, due to ropey soldering or not using a washer between coil wire lug/capacitor wire lug, doing the binding posts up tight mashes the lugs together & poor soldering will come adrift here.
Easy to miss if you have used heat shrink insulation on the lugs.

Where the wires exit the coil bottoms or the two coil wires join in the middle is another common place for the wires to break, screwing the coils down tight can turn them,

straining & breaking the wires.
If your coils turn when tightening the screws, those pliers with padded jaws come in handy for holding them still…don't go mad & give them a death grip, squashing the wiring though!
Be methodical & check all the wiring…a wire can break in the middle, hidden by the wires insulation.
For this reason, never re use old wire…come on guys….it's not expensive & you only need a few inches of it!

Wire breaks can cause erratic running of the machine too, as it heats up & things expand a bad connection at a solder lug hidden by insulation can move apart causing a mysteriously non functioning machine. Come back to it hours later & it's cooled down & the joint has contracted & made contact again.
This can be *really* frustrating!

Having checked all this & rectified any problems, the machine WILL run now.

Now the machine wants 'running in'.
'Hang' it by the clipcord & run it hard, over & above it's normal working voltage for a full twenty four hours.

A fully bedded in armature bar.

Always try to replace the armature bar in the same position on the machine, mark it in relation to the front coil core with a small dot of Tipex

She'll run warm & make some strange noises as everything beds down & settles in.
Check the tightness of all the securing screws, especially the coil screws while the machine's running in.

Machine settings.

Liner machines have a lighter-weight armature bar and a smaller capacitor around (15uF)
The air gap on a Short Stroke Liner Machine is 3/64" (dime), resulting in a speed of approximately 140 CPS (cycles per second) with a tube and needle set-up in the machine.

The Short Stroke Liner Machine generally has a 0.019” thick timing spring and a 0.018” thick main spring. The air gap on a Long Stroke Liner Machine is 1/16” (nickel) resulting in a speed of approximately 140 CPS (cycles per second) with a tube and needle set-up in the machine.
The Long Stroke Liner Machine has a 0.020” thick timing spring and a 0.019” thick main spring.

A Shader Machine has a mid-weight armature bar, somewhere around a 33uF capacitor, and a 0.016” thick timing spring with a 0.017” thick main spring. The air gap on the Shader Machine is 1/16” (nickel), resulting in a speed of approximately 110 CPS (cycles per second) with a tube and needle set up in the machine.
A dedicated Colouring Machine has a heavy-weight armature bar, a 47uF or above capacitor, and a 0.015” thick timing spring with a 0.016” thick main spring. The air gap on the Colouring Machine is 1/16” (nickel), resulting in a speed of approximately 100 CPS (cycles per second) with a tube and needle set up in the machine.

A specialist set of tattoo machine contact gap gauges.

To measure cycles per second, duty cycle, contact open/closed percentages, air gap etc., as well as the machines working voltage & current draw, you’ll need a power supply unit with a digital readout of all these values. A power supply such as this really does make life so much easier & takes out all the guesswork when setting & tuning tattoo machines. If your into your machines (& you should be, they are the vital tools of your profession) you’ll collect a load of tools along the way for setting, tuning & repairing them…

And accrue some spares too…

Having everything to hand sure makes life easier!

Oh, just one other very important thing.
They are Tattoo MACHINES….NOT ‘guns’. We really hate that…“wheredya get them tattoo guns from?!”
One is for shooting things & the other is for creating artwork in skin….two completely different things!

Just in case your confused, I’m sure the photos below will help!

Tattoo Machine.

Gun.

See the difference?!