Restoring a Pioneer PL-12D Turntable :

https://mr-ives.blogspot.com/2013/07/restoring-pioneer-pl-12d-turntable.html

July 28, 2013

I got back into vinyl records about 18 months ago, and have collected a few hundred albums, mostly second hand. I have a number of turntables (NAD 5120, Ariston QDeck, Pioneer PL12D) which I got also second hand. I keep a few, some end up passed onto friends, some that are too far gone are kept for spares. In most cases they have required a little work to get them running again.

Last week I was lucky enough to get a Pioneer PL-12D turntable from freecycle. The lady who offered it, said that she in turn had received it from freecycle , and had replaced the belt but couldn't get on with the springiness of it, and had got a modern USB turntable. I have previously worked on one of these decks, and know what she means about the suspension system used. While this blog is specifically about this particular model of deck, many of the concepts are similar to others from this vintage. Many Japanese belt drive decks throughout the 1970's shared very similar construction, so this may be of interest even if your deck is not a PL-12D.

The deck in question was in great condition, and very complete. Both the 45 RPM adapter and the additional screw-in balance weight (for heavier cartridges) were both included, and it came with a classic Shure M75HE Mk 2 cartridge.

I thought I'd do a short service on it. While the platter rotated, removing the platter and then turning the spindle by hand was hard, indicating maybe the grease had dried up. Also the motor made a bit of a knocking sound, again, possibly a lubrication issue, so a simple service seemed a good idea.

Here it is as received. First thing I did was remove the headshell which uses a standard SME-style collar fitting. Just unscrew the collar and the headshell and cartridge pulls off. I placed these safely elsewhere. I decided to get a new stylus as you can't tell how much service the old one has given. Clip the arm back in its rest. If this is loose just tape it in place so it doesn't flop around. These arms are pretty good, robust and you can see if the arm bearings are OK by checking there is smooth side to side and up and down movement. Also see if by very gently twisting the arm between finger and thumb is it has any rotational movement indication loose bearings. Don't force it, just the gentlest of twists is enough. Neither PL12's I've seen have had a problem here.

I then removed the lid. if you open the lid, then hold the back either side of the hinges. You will find a slight pressure to the right disengages the lid from the hinges which use a rather clever lug system.

I then carefully lifted off the mat which should come away from the spindle in the middle. It has a decorative metal hoop which sits in a trough in the mat,

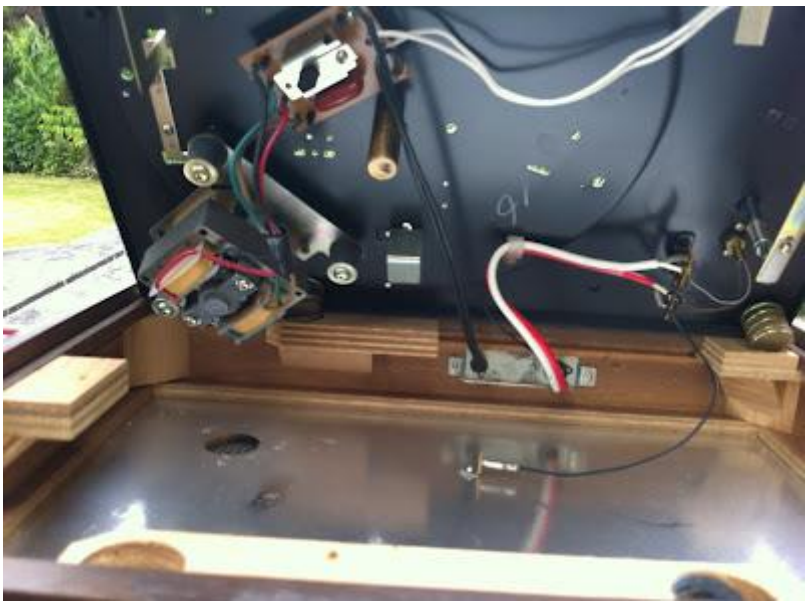
Now you can see the platter, and a couple of holes either side , if you rotate the platter you will see where the motor spindle has the belt looped around it beneath the platter. If you slip the belt off the motor through the hole you should be able to lift the platter off, a gentle vertical lift.
If its a bit stiff some gentle pressure on the spindle with your thumb while your fingers grip the edge of the platter. Put the platter, matt and belt safely to one side.

Here you can see the deck minus the platter. Top left you can see the motor pulley, and in front of that the speed selector mechanism which raises or lowers the belt of the motor sondle to sections with different diameters for 33 and 45. Next to the motor pulley is a little sticker, which indicates where the oil point is for the motor. This is a small rivet through the top plate to which you can apply a few drops of oil. These drop down into a trough on the top of the motor below and find there way to lubrication points inside the motor.

Gaining access to the underneath of the deck is very easy. Two screws on the top are slackened and you can then slide the screws and the brackets they connect with toward the centre of the deck. You are sliding two clamps from the wooden internal ledges they normally engage with.

Once these are slid to the centre the deck top should be able to be tipped up. Some care is needed as the cables are captive at the back and the 4 springs are still engaged in their 4 circular recesses, but I find holding the speed selector and on/off switches on the top , I can

lift the front. There may be a certain amount of "twanging" as the 4 springs are bent and flip out of their recesses. Below we see the tidy inside.



You will notice the mains cable enters via a plate at the back, and the red& white signal cables exit nearby. An additional wire joins the EMI screen on the base to the grounding point. You could remove the rear plate, unclip the black screen wire and have full access to the top, but here for simplicity I left it as is. I found I could use a wooden hammer as a prop, with the head inside the plinth at the front and the handle supporting the top by the front metal catch, rather like propping up the bonnet/hood of car.

As music is extracted from a record by transforming microscopic vibrations back into electrical signals, errant vibrations are hence the enemy of good vinyl replay. All turntables include some degree of decoupling i.e springiness, to isolate sources of vibration from the arm and platter. The motor is one source of vibration, the surrounding environment is another. Technically there are 5 systems used in the PL-12D:

1) The metal top plate is decoupled from the wooden plinth via 4 springs, which have foam rubber dampers, rather like the suspension and shock absorbers in a car

2) The motor is decoupled from the top plate by sitting on 3 rubber bushes via 3 retaining rods

3) The motor is decoupled from the platter via the drive belt

4) The deck sits of 4 rubber feet, though these are minimal in effect and are primary for grip and to allow air flow beneath the deck. You will see that beneath the motor is a mesh vent to allow some air circulation as the motor can get hot.

5) the record is decoupled from the platter by the rubber mat.

In the picture above you can see one of the 4 springs described in 1) with the foam plug still present. On inspection these were crumbling as can happen to foam rubber over time, and I discarded these to be replaced with new pieces of foam later. This was probably the cause of the problem the previous owner described where the deck would bounce around at the slightest nudge. This appears to be a very common problem with the PL-12D.

Of the 4 wooden recesses in the base for the springs, two had rubber washers in. On closer inspection one had two such rubber washers in, so I had 3 washers in total. These may be to provide further decoupling, but I think it more likely they are to balance the top plate i.e act as tiny shims. I removed these and put them carefully to one side.

In the inverted picture above you can see the motor. Note the black rubber bushes, which the motor sits on via the three threaded rods.

These rubber bushes can become hardened over time and this diminishes their ability to absorb the mechanical vibration from the motor, which gets picked up by the cartridge as a background hum.

NOTE: Update 2022. An enterprising gentleman in Sweden, Tom Silvennoinen, is selling new replacement rubber mounts made of modern silicon rubber and cast to the right size, and are a fair price. I know from the PL12D facebook group that these are excellent and remove

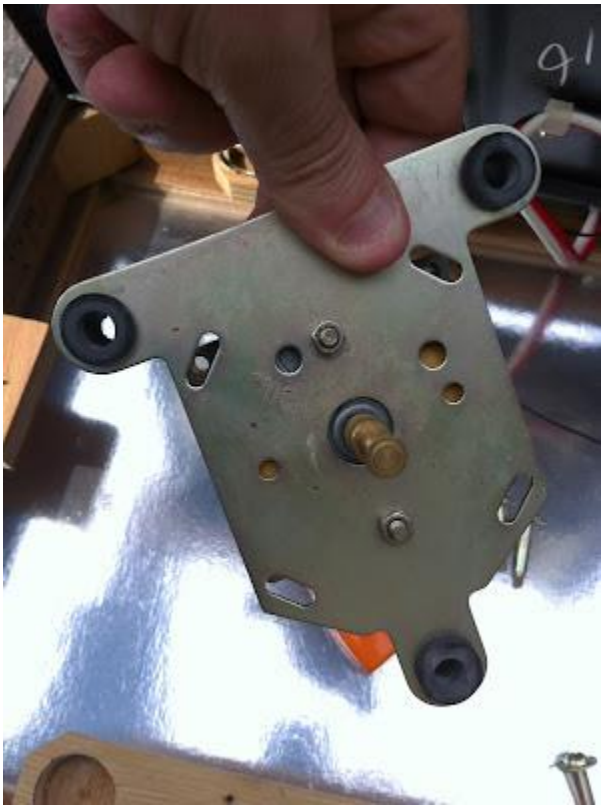
the hum completely. I'll leave in the section below describing how I restored the originals, but for best results try these:

link to new silicon rubber mounts

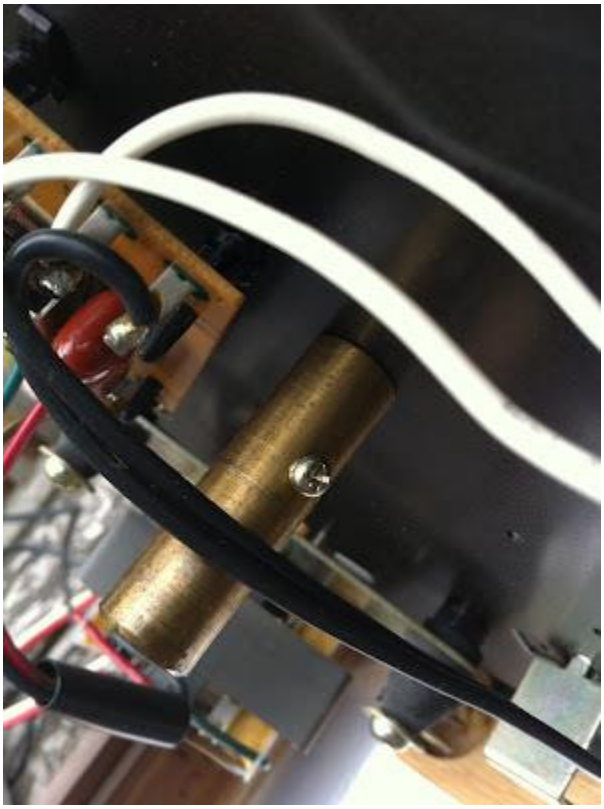
It's easy to unscrew the threes rods and detach the the motor from the top plate. You need a free hand to hold the motor as its still connected by wires, and quite heavy - its well built.

I wanted to lubricate the motor. It's possible to dismantle the motor to really clean and lubricate thoroughly, but that is a more complex process. I wanted to see if I could avoid that step if possible.

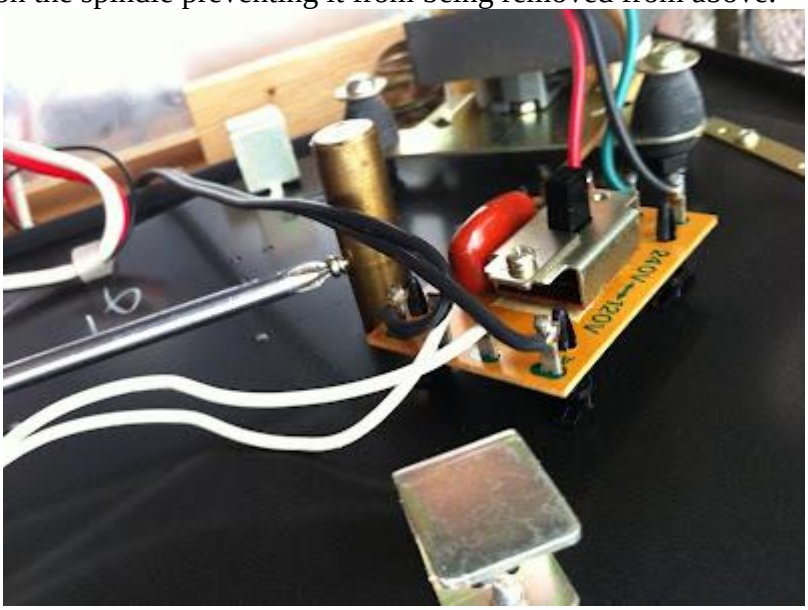
Here you can see the motor with one rod removed, free from the top of the plinth



Once all the three rods are removed you can see the entire motor top plate with the three rubber bushes . The grey hole at about 10 O'clock to the central spindle is the well that the oil point drips into. I removed the 3 rubber bushes and put them to one side. I carefully applied a few drops of sewing machine oil into the oil hole. The sticker on the top plate says 2-3, but as this deck had not been used for some time I put in 6 assuming some may pass through in a flushing process. I then sat the motor carefully in the base of the plinth below where it usually hangs from the top plate.



Here you can see the underside of the top plate. The next job while the motor is getting oiled, is to look at the main bearing. The spindle is the piece of steel rod which supports the platter and forms the rod you stick the record on. On the PL-12D the spindle is captive i.e you cannot remove it from above without first loosening a screw beneath. In the picture above you can see the brass well which the spindle sits in. The screw in the side engages with a recessed waist on the spindle preventing it from being removed from above.



This inverted picture shows me loosening the screw. It doesn't need to be completely extracted. Eventually it will be out sufficient to allow the spindle to be extracted. Once I had removed the spindle , on inspection there was a lot of brown hardened grease on the shaft. I placed the spindle in some hot soapy water to gently remove the worst.

Inside the brass well should be two things. Some more grease, probably hardened too, and a ball bearing. It's always possible that the bearing comes out with the spindle, stuck to the end, or that a previous owner has lost it. If it is still at the bottom of the well, you either have to very carefully invert the deck, or use a soft , non-metallic implement like a small drinking straw, to extract it from the bottom of the well without scratching the sides. Once out you can clean it , again in soapy water. If you loose it or it appears to be absent its a 1/8" steel ball. I previously lost the bearing on another PL12 and got a pack of 30 from a cycling shop, they are not difficult to find cheaply. As these ball bearings can become pitted or worn, its worth checking the old one (see ***Update May 2014*** below). Once the ball bearing is cleaned it should be shiny and if you roll it around on a very flat surface i.e a mirror or sheet of glass, it should roll freely and quietly in any direction as you tilt it. a Worn bearing will be noisier and roll erratically, and may have a dulled colour. if in doubt replace as they are cheap for a bag of 20 from a good cycle shop or from on-line source. 1/8" steel ball bearing.

While warm soapy water got rid of some of the grease, it didn't get rid of all of it. I used Servisol Switch cleaning and some rubbing with a soft cloth to clean the spindle shaft to shining. I used the same liquid and a dozen cotton wool buds to clean the inside of the brass well until the buds were coming out clean and not yellow from grease or grey from steel filings.

Now all the rubber bits I extracted, I put together including : the matt, the belt, the 3 washers at the base of the springs, the three bushes that support the motor. I should have included the 4 feet which screw into the base, but they looked OK and do not really need the next process.

In a separate blog I restored a turntable mat from dull grey and hard to black and supple using Platanclene Printer Roller restorer. Again here I put all the smaller pieces in a plastic sandwich bag along with a few squirts of Platanclene , then worked the fluid into all the rubber parts, especially the bushes around where they slot into the motor top plate.

I also sprayed Platanclene on the mat and gave it a good wipe, repeating on the other side

While the platanclene was doing its magic, I dropped the ball bearing back into the well and dipped the lower half of the spindle into some fresh oil, then reinserted it back into the brass bearing well.

I use Chain saw oil, which is a little thicker, but most synthetic oils will work. Some favour sewing machine oil. Once the spindle is back in and settled, I tightened the retaining screw on the side. The spindle now turns smoothly and easily.

I replaced the rubber parts I'd removed from the motor, they just press and pop back into place. I reattached the motor with its 3 screw in rods. I also replaced the 3 spring washers. I don't yet have any foam rubber for the springs, I'll cover that later. I gave the plinth and top plate a wipe with a damp cloth.

Don't forget the two retaining sliding screws, then the top plate is unable to fall out of the plinth. I then replaced the platter with the belt looped over the spindle via the two access holes in the top of the platter. last of all the mat goes on with its silver ring .

I have not yet re-attached the headshell as I am awaiting a replacement stylus and intend the final set-up of the deck as a second blog, including the foam rubber damping inserts in the four springs. This was just about the restoration of the parts

With everything back together, I left the deck running for a few hours in order that the motor and bearing lubrication could work its way into the various parts. The motor can get warm, which helps get the oil worked into all the dry parts.

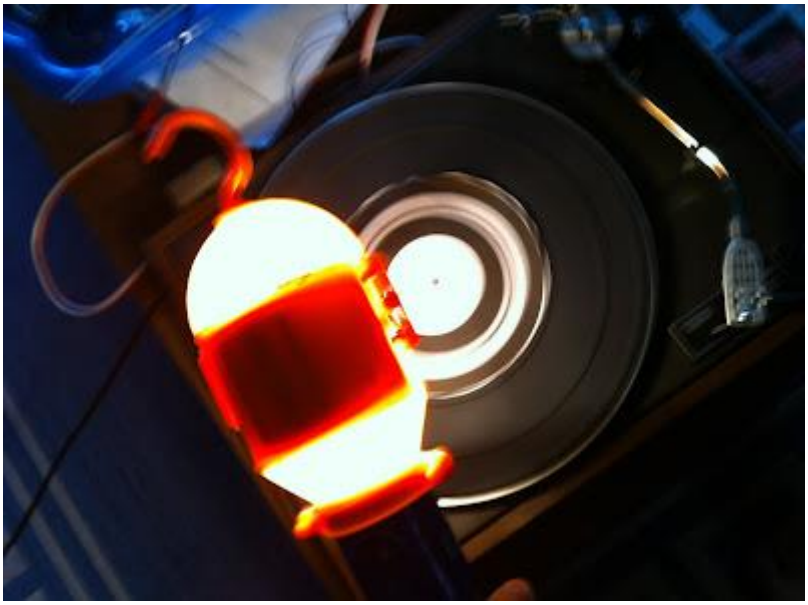
After a couple of hours I listened close to the deck and could hear little sound from the running motor or the bearing, which indicated to me that they were running very well

Next , replacing the foam inserts, fitting a new stylus and setting the arm geometry and settings .

I found some dark grey foam rubber which had be used in the packaging of a watch. It seemed reasonably springy, some foam used for camping mattresses can be rather dense.

I cut 4 wads of foam, roughly the size and shape of the space inside the springs, and stuffed these into each of the four main springs as you see. Once this is done and the top lowered back into place, the deck looses the unmanageable springiness. The suspension is stiffer and slower, with less bounciness.

I had ordered a new replacement stylus for the M75ED cartridge. Shure no longer make this cartridge and replacement styli are made by various 3rd parties. In the end , on the advice of CliveUK from the vinyl engine forum, I elected for an N75EJ stylus from the German ebay seller elec64 which cost £18 and arrived within a few days - excellent service. The old stylus slid out , you can see it above. The new stylus plus into the cartridge. The colour is different , the new cartridge has a light green front.

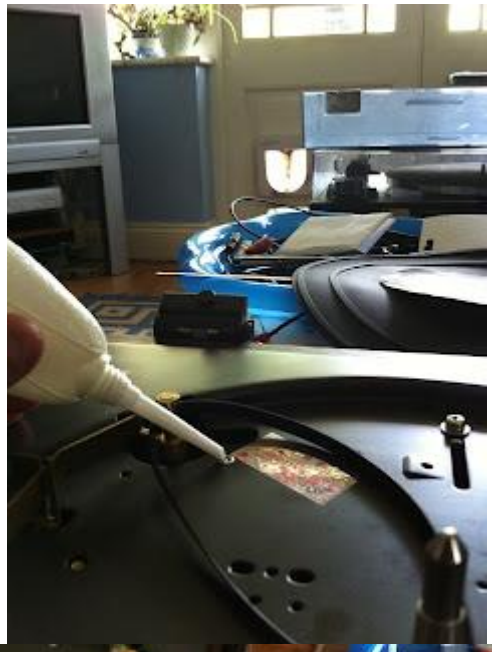


I fitted the headshell carefully back in the arm. Next thing to be tested was pitch i.e does the platter turn correctly at 33 1/3 or 45. if the pitch is out , then notes will sound too high or low in pitch. Basically everything will sound wrong. Pitch problems can be an issue with belt drive tables where the belt can slip a little if old. The motor spins at a common speed determined by the mains frequency which is 50Hz in the UK and Europe but 60Hz in the US. As the motor spins at slightly different speeds in the two countries the deck came originally with different motor spindles for different mains frequencies to achieve the correct speeds in different parts of the world. This deck was a 50Hz unit , so if there was a pitch problem, I was a bit perplexed what I could do about it.

The easiest way to measure pitch with this deck is to print off and cut out the vinyl engine pitch disc on a piece of A4. You cave to prick out the centre hole with a pin.

Next put the disc on the platter , over the spindle and start the deck. If you shine a filament light on the disc while turning , the dashed lines will appear to either move slightly one way or the other , or , ideally remain still. This is because the filament lamp is pulsing at the mains frequency creating a stroboscopic effect with the marks on the spinning disk. At the right pitch the lines will appear to remain fixed.

On this deck, when set to 45, the inner set of lines , remained still which is right, however on 33 they did not , appearing to advance clockwise. I also noticed two background noises. One a "motor boat " style gentle knocking noise from the motor, the other was a scraping sound. I wondered first if the deck lubrication was insufficient



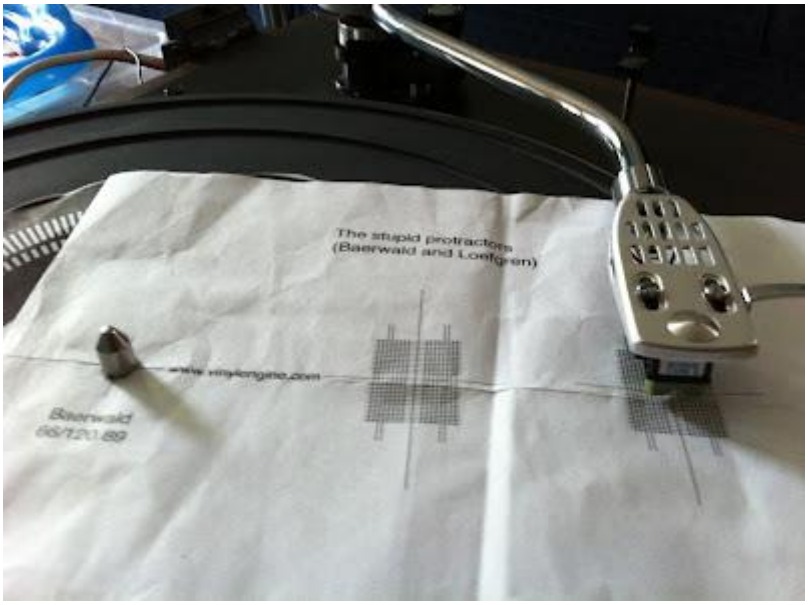
Two more drops into the motor. I then removed the spindle again, cleaned off the oil and tried a thicker Castrol Moly Grease , in case the noise was some scraping in the main bearing. I've used this grease before where I appeared to have some play in a bearing and it seemed to work well. It contains Molybdenum Disulphide .

Niether addressed the problem. Then it occurred to me that if the 45 speed was correct, then it

wasn't an issue with the performance of the platter and spindle as they were fine at that speed.

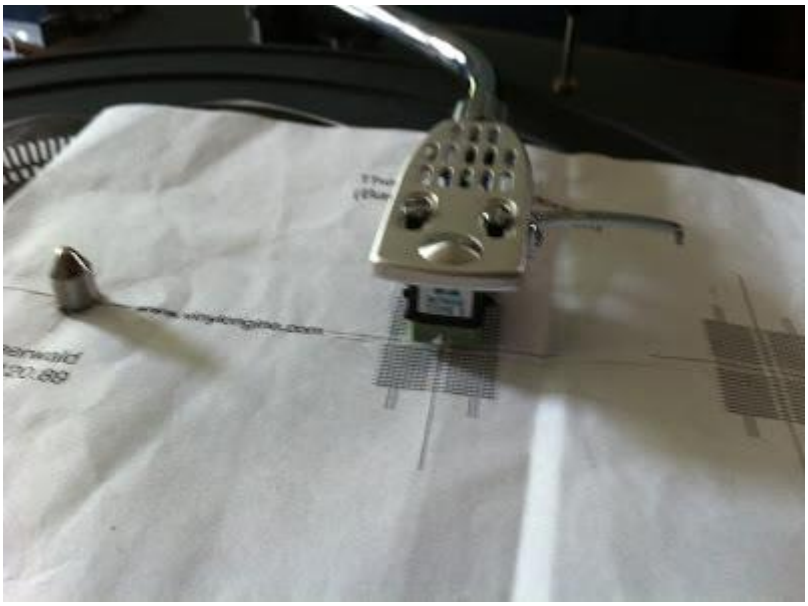
On closer inspection through the platter I could see that the speed selector was not pushing the belt far enough u the spindle to obtain 33 1/3 speed. The belt was partially on the conical section between the different diameter sections of 45 and 33 1/3. hence the pitch issue. In addition i could see that the belt was fouling on the alloy speed selector arm that pushes the belt up and down on the pulley, but only in the 33 position. Mystery solved.

I tried tightening the screws supporting the speed selector arm. The correct thing to do would be to slacken the tiny screw in the side of the spindle/capstan and lower it a tiny amount on the motor shaft. In the end though I gently widened the C end of the selector arm , until it neither rubbed the belt , not left the belt half way between 33 1/3 and 45 as had been happening. The deck now spun at the correct speed as checked with the strobe disc and the rubbing noise I had heard was gone. There was still some very quiet "motor boating" noise from the motor i.e a bu-bu-bu-bu-bu, but I decided to leave that for now.



The next thing was to set the arm geometry correctly. There is a lot written about this subject, and I will not go into a great amount of detail here. Basically if you consider a record to be made of a single circular spiral from start to finish. the spiral is almost perfectly circular, and for the stylus to sit correctly in the groove, it has to be at a tangent to that circle, ideally from start to end. That would mean that the cartridge should be at 90 degrees to the radius of the LP. If you look at the arm on the Pioneer (and about 99% of all other turntables) you will see that the arm can only move in an arc. It cannot be at a perfect tangent to the radius of the record from start to end as I have just described. This is a fundamental and well understood problem with LP reproduction and various ways have been devised to try and address this. One is tangentially tracking arms which slide along a rail at the back and attempt to always hold the stylus at a tangent. The other is an arm (the Garrard Zero Deck) which moves the headshell continuously. However both have had different issues and the turntable arm as found in the pioneer has been the best compromise in sound quality, whether it is S shaped as here or straight as you will see in other models.

In reality its not so much of a problem. It has long been understood that setting the arm and cartridge can be achieved using two points i.e two places on the record where we can achieve a reasonable equivalence to a tangent. there are several geometries that are used, but I use the simple Baerwald geometry, and like the strobe disk, Vinyl Engine has a print-out and use protractor which you can get here . You print it off, prick out the spindle hole with a pin and lay it over the platter mat surface with the power to the deck turned off. You can see this in the picture above. Baerwald assumes that the best arrangement is that the stylus is in as best position at the start and end of the LP side. Others geometries favour 2 positions closer to the middle.



If I lower the arm I should be able to land the stylus (very carefully) on the cross lines of each position. Note having aligned the outer position I have to rotate the protractor further around to coincide with the second position. Doing this is fairly easy, however in each position the sides of the cartridge should be parallel with the grid lines on the protractor, which hopefully you can see is the case above. If they are not parallel when the stylus is over the cross, you have to make some adjustment. This is done by gently loosening the cartridge screws, not too much, just enough to be able to slide it backward and forward. You then have to experiment with different positions of the cartridge in the head shell i.e further forward or backward until

you find a position where both the stylus and parallel lines are correct with the protractor.

It can be fiddly and frustrating, and may require glasses or even a magnifying glass to see, the Shure cartridge has a nice large square body, and is easier to see. Some of the Ortofon OM range have a narrow body which is even harder to see. It might also be that for a given arm, and cartridge the cartridge has to be slightly slewed in the headshell i.e the bolts through the headshell slots are not the same distance front to back.

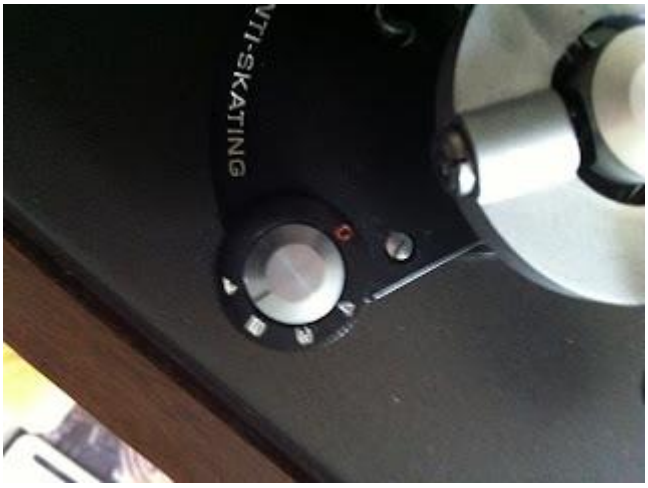
I have done it many times and it gets easier, and it may only need to be done once. Once you have the cartridge correctly aligned in the headshell, tighten the bolts but not too much, or you may deform the headshell .

The next thing to set is the tracking weight. This is the weight of the stylus on the record and is measured in grams. Too low and the sound will be thin and distorted, to high and it will sound thick and worse you will damage the stylus and your records. The manufacturers typically give a range for a given stylus. , and I tend to play safe and choose the middle , which for the Shure is 1.75 grams.

How you set and measure the weight is , again, a subject of debate. the approach described in the Pioneer user Guide (also available from Vinyl Engine) , is to adjust the balance weight - the large round silver barrel at the end of the arm. This can push on, but then should move in and out using a screw action. You should slide that back until pressed against the balance weight and with the Zero digit aligned at the mark on the arm tube.

 So rotating the arm Balance balance weight screws the weight in or out. First you find a position where the arm floats if out of the cradle and the Lower switch in the down position (and power off at the mains). It should float parallel with the record surface, neither pointing up or down. This is the balance point. Once you have found this, and with the black adjustment collar set to Zero, you have found your zero point. Now you can turn the numbered collar AND the weight together, until you set it to the designated tracking weight, in my case 1.75grams. Once this is set the arm will no longer balance but tip downward with a gentle force.

Now I find this approach rather to fiddly and probably inaccurate, so I use a set of digital scales which I got from Maplin or ebay for £15. They display the weight of the stylus and I adjust the balance weight assembly until I achieve the target weight, or as close as I can get it.



Once the tracking weight is set you are almost done. There are three remaining settings. First bias aka Anti-skate . On the Pioneer and many other decks this is set via a small wheel and is set to the same value as the tracking weight i.e 1.75 for me. This function compensates for the effect that inertia has on the arm, where the stylus will have greater pressure on the outside groove wall than the inside.

The last two settings are VTA and Azimuth . There are no formal means of setting these on

the PL-12D, but worth checking. VTA is the angle at which the tonearm is when playing a record. Ideally the arm should be parallel with the surface of the LP when viewed from the side. Some arms allow you to set this by adjusting the height at the base of the arm, for example SME. On a deck with integral arm there may not be an adjustment for this. It may never be perfect as vinyl thickness varies.I mention it for completeness, but there is not much you can do and it should be right on the pioneer with the pioneer mat. Different mats may have a different thickness which will in turn change the height of the LP surface and hence the VTA. However , vinyl comes in different thickness's also, so it will never be perfect. On the Pioneer it was good enough

Finally Azimuth is checking the arm from the front to see that the cartridge is not leaning to either side. Some people advocate turning off the power and lowering the cartridge on a small mirror so you can see the reflection . It makes it pretty obvious if the headshell has become twisted on the end of the arm. It may be possible to loosen and tighten a screw holding the headshell collar fastener if its out. Its shouldn't be but its always possible that a previous owner might have done something odd to the headshell and warped it. The advantage of the Pioneer is it takes SME-standard universal headshell's, so a replacement can be obtained pretty easily. A few headshell's (Ortofon and Sumiko) have an azimuth adjustable collar, but these are very expensive and if the azimuth is that far out, something else must be badly wrong. On this PL12 it was fine.

With everything set and checked , time to play some music.

The Sound is good, the Shure cartridges have a reputation for a warm lush sound and this does not disappoint. Still a little motor noise, but this is physical rather than electrical, and the deck has less hum than any other I've tried. With no music playing if I turn the volume I need to go to around 90% till I hear any hum through the speakers.

I might at some point investigate striping down the motor , cleaning and re-lubricating, but for now I'll just enjoy

Update August 29th 2013

the deck has been sounding great, but I still believed it was playing slightly fast. I'd fixed the major speed problem earlier with the speed adjuster leaving the belt halfway between 45 and 33 on the spindle. It was running with the belt fully on the 33 part of the spindle yet it was slightly fast. I confirmed this with the strobe disc and it was audible on familiar tracks.

The previous owner had replaced the belt, and I'd measured its circumference (lay the belt in a single line, measure and double) and it looked to be the right size. I figured I had nothing to loose by ordering a new belt and again William Thakker has specific belts for the PL-12D. I got his through his main German site as he doesn't list all his stock on his ebay site, service as good as always, about 5 days to the UK.

Comparing the new belt there were two significant differences. The Thakker belt was slightly looser, the original belt had been very tight around the inner platter surface. Also the belt was thinner. I mean thinner not narrower, so I refer to the thickness of the rubber. This was probably it, the slightly thicker belt was changing the geometry of the system of pulleys that make the deck turn at precisely 33 1/3.

it now plays at precisely the right speed confirmed by both the strobe and the ear.

Im really enjoying this combination. The Pioneer/Shure combinations is not the last word in

detail and has a very warm lush sound, but I like it and its very forgiving of albums which have had a tough life. I've a few charity shop albums which I paid little for, have surface noise and scratches but I still love, and this deck really makes them sound as good as they can be.

Update November 2013

The deck has really been sounding lovely. I've been using it with both the original Shure M75 cartridge (new stylus) and a similar vintage M95, again with a replacement stylus. The M95 is a very different beast than the M75 and is much more revealing. Like the Ortofon OM20 it seems to dig deeper for bass. Its more revealing , which can be very good for great recordings. I'll keep both cartridges in headshell's so I can swap between them.

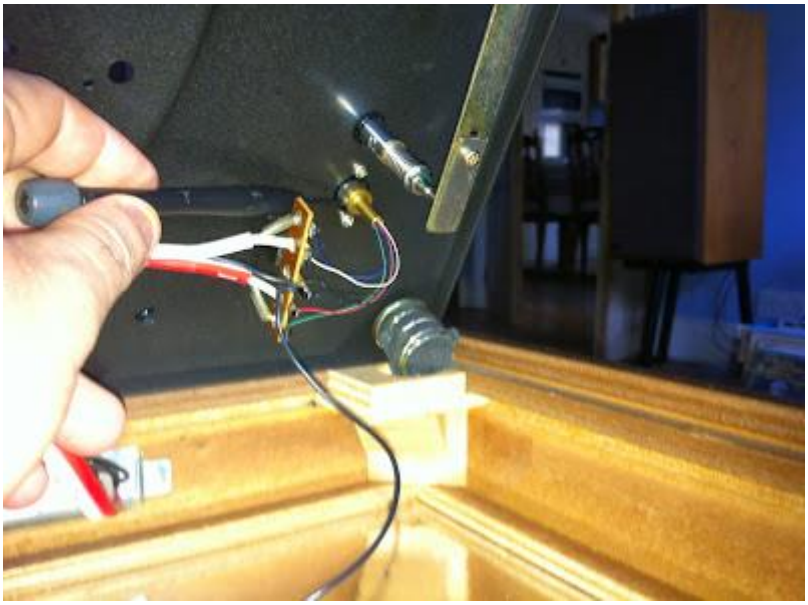
I had two minor issues with the deck I wanted to resolve . the first was some moderate play in the tone arm bearing. Side to side and up and down movement was excellent, but when replacing headshell I'd noticed some "play" if I applied a gentle in-and-out force. gently hold the arm at the bend near the headshell and apply a very gentle movement in the direction of the arm main bearing. For example if the arm is close to its clip, this would equate to a gentle, gentle force toward the back of the deck.

This seemed to me to be perhaps some looseness in the horizontal arm bearings which often used a ball-race system .

I opened the deck up, following the dismantle sequence steps I details above.

In the picture above you can see where the arm wiring emerges through a brass tube. These wires are very fine and delicate so great care is needed. If I carefully applied the in- and-out force on the arm above, I could see some corresponding tiny movement in the brass tube. It has a larger brass collar, and on inspection the brass collar is threaded i.e screwed onto the brass tube like a round nut. I believe that the wider brass collar holds tiny ball bearings in place above it and forms the lower part of the horizontal bearing .

On the side of the collar is a tiny screw, the function of which is to lock the collar in place . I wondered if age, wear, and gradual slackening was the cause of the play here ?



I gently slackened the side screw with a very small jewellers screw drive (cross head). I found that I could then very gently tighten the brass collar with my finger tips, as one would tighten a nut. I did this only just finger tight as too tight would create too much pressure and friction on the bearing. Using the side screw position as a reference I found that if the screw pointed to 9 on an imaginary clock face, then I could tighten it to 10 or 11, without applying any undue force.

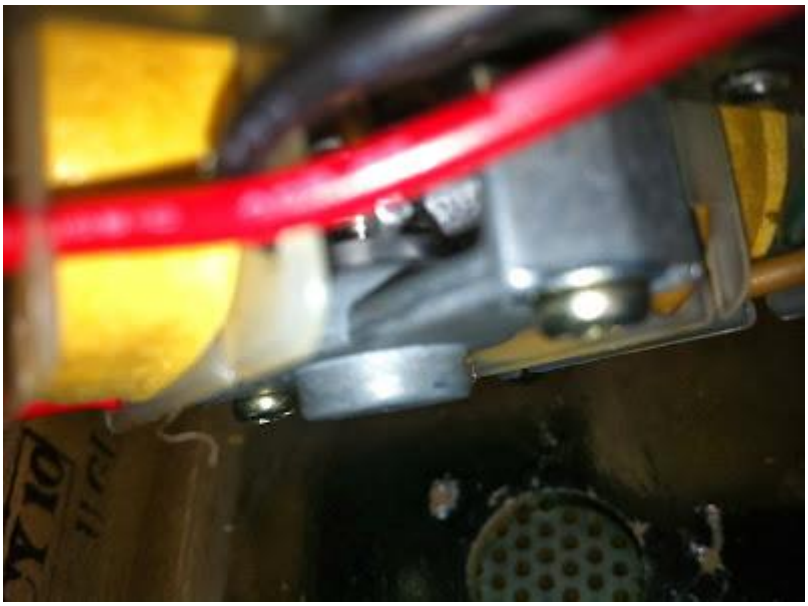
re-tightening the side locking screw again, I gently moved the arm. It still moved freely side to side but the in and out play was gone . Excellent.

The other thing I wanted to explore was slight noise from the motor. This is very quiet but its a rythmic knocking noise I assume with each rotation i.e at a 50Hz frequency. Its barely audible, and then only with my ear close to the motor spindle, but I have had AC motors which were silent before, so wanted to try to achieve this.

My theory was that while the top motor bearing was getting oil, the lower bearing might have dried. Here is a picture of the motor.

PLEASE NOTE The mains lead and plug has been disconnected from the wall throughout this operation. NEVER rely on the switch on the deck as the internals will still carry live voltages .

here you can see a side view of the motor. While I'm sure that striping the motor and re-lubricating is probably the right thing to do, I'm not sure I could get it back together to an equivalent or better tolerance. Those bolts go right through the motor, holding together the top and bottom bearing frames and the laminates around the core. They all have to be aligned. In the picture above you can see an aluminium tooth close to the red wire inside the motor. There is a toothed gear on the base of the motor, the function of which I suspect is to act as a fan to promote air flow.



Again here you can see the the fan from the side. My thinking was that beneath the fan there may be access to the main motor spindle. If I could get a drop of oil on that it would gravitate down into the lower well.

This requires care as squirting oil indiscriminately inside a motor will certainly damage it

Again I used my precision oiler. Gently probing with the nozzle while lifting the motor pulley from above to create a gap where the oiler might find the lower part of the motor spindle.

Once found a single gentle squeeze, remember we are trying to get a single droplet in the right place, not flood the thing.

Putting the top back in place I plugged the deck in and ran the motor , minus the platter. The noise seems quieter, but its still present. Maybe its not a lubrication issue but one of oscillation i.e if the armature is not held firmly in place perhaps its wobbling as it rotates ?.

Its not really a problem, I can live with it. Maybe I need to find a dead PL-12D motor to practice on, which might be something to look out for on ebay.

Update December 2013

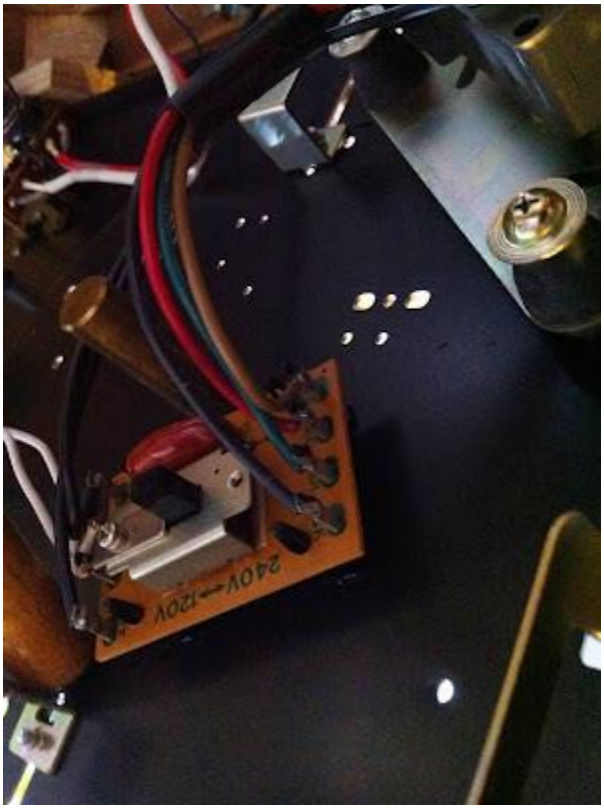
Well I couldn't resist. Spurred on by comments on my blog and from vs_music over at the vinyl engine forum, I decided to strip and clean the AC motor. This was to try and resolve some mild "knocking" sound from the motor. However it took a few goes and is still not perfect, so this is not as simple as replacing the foam or servicing the rubber supports, and only recommended for users with nosy motors as a last resort. However I thought I'd share what I did, not every fix goes perfectly . Perhaps my motor is a little noisy and there is nothing I can do. Your mileage may vary.

WARNING : The following procedure is only to be undertaken if you are competent with a soldering iron and understand and undertake all necessary electrical safety precautions. These decks contain Live AC mains , so all procedures are undertaken with the deck disconnected and unplugged from the AC electrical supply. If in doubt use a competent electrician or repair facility.

First of all, as above remove the mat, platter and belt and the cartridge and store safely.

Slacken and slide the two screws which secure the top plate. Also with this process I found it useful to remove the two small bolts which hold the rear signal and power plate on. At the rear of the deck is a small metal plate through which both the signal, ground and mains wires pass. Remove the two bolts either side such that the plate can fall inside the deck..

Carefully lift off the upper plate assembly. You will find a grounding wire which connects to a tag on the base board of the deck. This pulls off, so disconnect this also and taking great care flip it over and lay it upside down such that the arm is inside the wooden plinth . Take great care to ensure the arm doesn't foul on the inside of the plinth. This seems drastic but there is not really enough room to work on the motor using the propped car bonnet/hood approach as earlier.

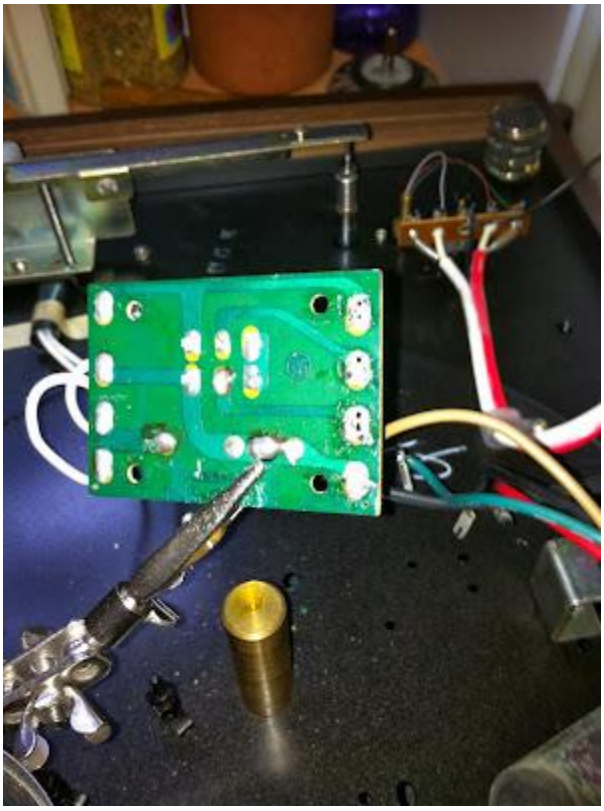


You can see the motor on its 3 rubber mounts. From the motor are 4 coloured wires which connect to a small circuit board. This board has a switch which is secured in position by a metal plate. This is to select between two voltages 120v and 240 v AC.

To access the motor its easier if you can remove the motor from completely from the deck. Each wire is soldered onto a tab, which is soldered in place on the circuit board. It's probably

hard to remove the wire from the tab, but I found it not too hard to remove the tabs from the circuit board by de-soldering them . I used a vacuum de-solder pump, but solder braid or wick should work.

First you need to get the circuit board off of the 4 plastic compression clips which hold it to the upper plate. these can be squeezed and the circuit board carefully prised off.



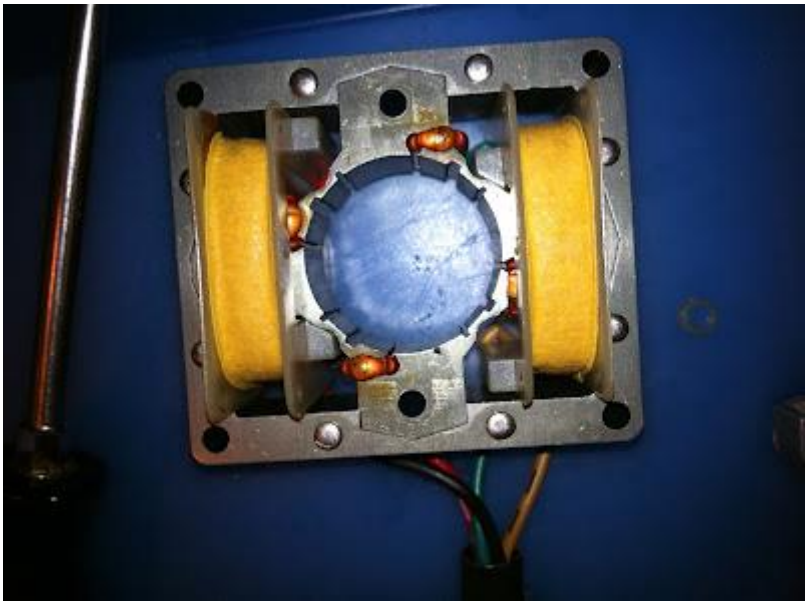
Here it's useful to use a craft stand / clamp to hold the board as you need to operate both a soldering iron and de-solder device applied to each of the 4 solder pads. in the picture above you can see a number of tabs removed. This is a gentle slow process, removing as much of the solder from each tab base as possible , then gently working loose while applying heat with the iron. Eventually I got all 4 loose and disconnected the motor from the top plate via the 3 bolts.

Then remove the top mounting plate from the motor. This is held on by two nuts and split washers. I also remove the brass 45/33 RPM spindle which is held on by a small grub screw. Keep these and all other parts safe, I tend to use a plastic tea tray to store stuff on.

The motor frame is held together with two bolts. These are secured by two bolts and two further nuts (now removed) held the mounting plate to the motor.

carefully remove the bolts using a good quality Philips Screw driver. These bolts are quite soft so I would not use a motorised screw driver, as it would be too easy to deform the screw head. The nut on the other side site in a recess and none of my box spanners were slender enough to be able to grip but I found the bolts came loose anyway.

On the upper side of the motor spindle a small clear plastic washer fits tightly on the motor spindle. I slid this off and stored safely.



Once the bolts are removed you can access the central rotor (pictured below) and remove the upper and lower bearing mounts, leaving the outer stator (pictured above)

Here is the central rotor part. Both the rotor and stator were clean and the only treatment I gave the rotor was to wipe the two steel rod ends with a clean cloth.

Above you can see the two bolts , nuts and split washers, the brass 45/33 motor spindle AND the upper and lower bearing frames. These last two were the focus of my work.

Here you can see the inside of the lower bearing. There is a bronze internal bearing into which the motor spindle sits . In the very centre you can see a mark which a wipe with a cotton bud removed. It appeared to be some black dirt in the bearing well, possibly original grease mixed with worn metal.

Here you can see the underside of the lower bearing frame (top) and the upper bearing below with its distinctive oil trough, through which you can oil the motor. The trough sits below the oil hole on the turntable top plate. At the right end of the trough you can see a tiny lighter grey section. This is the edge of a felt collar around the bronze bearing. When you oil the deck the lubricant soaks into this felt collar which ensures that the oil stays in the bearing and does not drip down into the motor.

Here is the underside of the upper bearing frame with the bronze collar bearing clearly visible .

I wiped out any obvious dirt from the bearings with cotton buds. I then gave each bearing a good long spray with servisol contact cleaner to try to dissolve any existing lubricant in each bearing. I left the bearings to dry out on some kitchen roll, then repeated again, and again. I worked the bearings by wiggle the rotors spindle back, forward and round and round in each copper bearing, again to try to dislodge any grime.

I then left the two frames to dry out on some more clean paper kitchen roll.

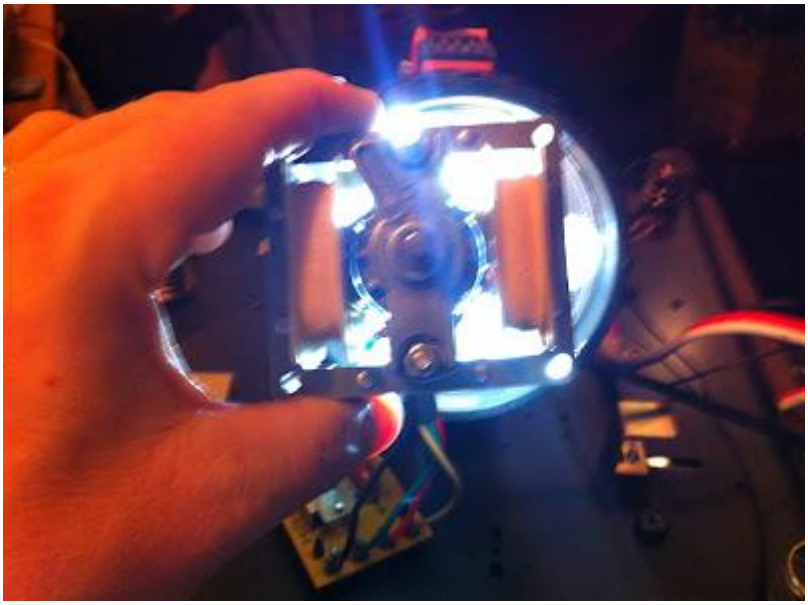
Once completely dry I soaked the interiors of each with light sewing machine oil. actually filling the lower closed bearing well to the brim. I left this to soak in for 10 minutes then tipped out the excess, soaking it away with cotton buds and tapping the frames on kitchen roll. My hope was that the internal felt collars would have been cleansed and re-soaked in oil. I also decided to put a small blob (Size of a small grain of rice) of silicone grease in the lower well, as this is inaccessible when the motor is reassembled, and oil from the top trough never makes the lower bearing. I figured a tiny blob of silicone grease should keep the lower bearing reasonably well lubricated

Now reassemble the motor with the rotor in the middle and the top and bottom bearing frames, the bolts and split washers and the clear plastic washer on the spindle as before. Tighten the bolts to just tight, not too tight.

Now care must be taken to align the end bearings in such a way that the rotor spins freely. There is some play in the precise position of the bolts and the end frames, which in turn allows the rotor to be off centre. If way off the rotor will actually rub against the inside wall of the stator. twisting the motor enables you to judge if its freely moving.

There has to be an even gap between the rotor and to stator wall. . Its possible to have no rubbing yet still have the rotor slightly off centre. I did this, put the deck back together and had a loud knocking sound from the motor.

The best way to avoid this is to look at the motor from both ends and judge the size of the air gap around the rotor. It should be even when viewed from both ends. This is easiest done when shining a torch from behind the motor.



In this blurred picture (sorry !) above you can see a thin but even halo around the rotor which is even on both sides . Check this from both ends. Once its seems even, it's time to tighten up the bolts.

Again check the rotor spindle turns freely.

I then reversed the above process, attaching the motor to its decoupling plate then re-soldering the 4 tabs to the circuit board and reattaching it to the top plate via the 4 plastic push clips. The colour coding is written on the circuit board so hard to get wrong. You are looking for a good clean dome of solder on the base of each tab on the lower side of the board.

Now flip the top plate and reattach the internal lower shield on the base board, the top plate secure bolts and the plate at the back. The deck should now be as before but without the platter and cartridge.

At this point I plugged the deck in and flipped the front switch to ON-UP

The first time I did this I was disappointed to hear even louder knocking sound from the motor. However this was due to me not centring the rotor rigorously enough (as I later did with the torch as above).

I pulled out the mains plug, then revisited the motor and loosened, re-aligned and re-tightened it without de-soldering the motor, i.e I did this with the motor detached from the bolts but still wired in place. I couldn't really face de-soldering again and I don't think the tags will take a lot of de-solder/re-solder. So you see t is technically possible to strip the motor with the stator wiring still in place, but its not as accessible. Possibly if you are uncomfortable with soldering you could consider this approach.

After carefully centring the motor, I fitted it back and plugged the deck in and flipped the switch to "ON-UP".

Motor turned and was almost silent, just the faintest whisper. Excellent, this was what I'd hoped for. I left it running for about 30 minutes, then suddenly it was noisy again !? Not a knocking sound, just louder.

Disconnected from the mains and revisited the motor again. I tightened the bolts a bit more and also the three bolts securing the motor beneath the top plate holding the rubber mounts. These were looser from before.

Re-connect, "ON-UP" and again silent.

Left running for about 40 minutes then knocking sound again. This time quiet and similar to my original motor-boat style sound. This was just with the motor running, no platter or belt in place.

So ....I'm sort of back to square 1. I have stripped, cleaned, re-lubed and reassembled the motor. At one point I had total success, but it has reverted to as before. I don't know if further alignment tweaking might help. This motor gets hot and I wonder if the problem is temperature related. I'll leave it for tonight and see if its quiet from cold in the morning. Its no worse than it was before I started this, so I'm no worse.

In the morning with the deck cool I tried again and there was still some slight knocking sound present so my thermal expansion idea seems to not be true. I find it odd that the motor was silent for about 30 minutes , and YES it was switched on (I have made that mistake before :)

I decided to fit the platter, mat and belt and this reduced the sound to very quiet indeed. Not silent as before but quieter than it had been, so this is progress as before. Perhaps the belt tension pulls the rotor into a better alignment or prevents the oscillation which creates the knocking sound ? I think it's also possible that the revolving platter improves the motors cooling. The underside of the platter has some features which perhaps help to carry hot air away from above the motor. Running the motor for a while with the platter removed perhaps does not allow sufficiently rapid cooling ? Not sure, but it's possible .

Its not perfect, but its pretty good. I'll leave it running for a few hours to see how it behaves when hot, and these motors do get hot

Update May 2014: "*I hear you knocking ...*"

I'd started to notice a knocking sound coming from inside the deck. It was random, maybe one knock every 10 minutes or so. Not rhythmic. It shook the whole platter and at first I wondered if the motor spindle was somehow catching on the bottom of the plinth. On investigation it wasn't. I removed the matt and took the belt off the motor. Even spinning the platter by hand , I was able to hear the knocking on at least one occasion.

After scratching my head, I decided it must be the main bearing, so I removed the platter, and loosened the side screw on the brass bearing well. I removed the spindle and fished the ball bearing out carefully, using a magnetised screw driver.

Even after cleaning the bearing looked dull and grey compared to a new bearing. I got a sheet of glass and rolled the old bearing around on it. The ball appeared to roll erratically if I tipped the glass and was quite noisy compared to a new bearing which rolled smoothly in any

direction. Examining the bearing with a magnifying glass I could see that while still round, some surfaced were pitted.

I decided to replace the bearing with a new one and re-lubricate the spindle. However the end of the spindle that sits on the bearing had a tiny dimple in it. My belief is that this was caused by wear against the worn bearing. I got this deck for free and have no idea what its history is you see. Possibly if the deck had been stored un-lubricated or run in that state it could cause wear ? Over at the vinyl engine forum, the authority on the PL12, user vs_music believes that the dimple was machined onto the bearing to better sit on the ball. I'm not so sure, as I don't see why the designer would want to increase the contact area between spindle and bearing. The point is to have the minimum point of contact.

After pondering this I asked a favour of a neighbour, who is an engineer and has access to precision lathes. He polished the end on a lather to a smooth mirror for me.

I put the new bearing and spindle back together with a few drops of sewing machine oil. At first there was some grind, but once the oil had eased around all surfaces it span smoothly. With the platter in place but no belt, if I spin the platter it will turn for several minutes from just a gentle spin.

The knocking sound has stopped, and the deck is sounding very good indeed with a Shure M95 cartridge and Jico replacement stylus. I have just taken delivery of a Denon DL-110 to try in the deck.

Update July 2019

Received a fascinating article on servicing these decks from correspondent Dirk Sipes, reproduced here, definitely worth reading

https://mr-ives.blogspot.com/2019/07/pioneer-pl12d-service-revisited.html

Update Feb 2021

There is an excellent facebook group dedicated to the Pioneer PL12D decks, and similar. Very friendly, lots of sharing of tips and advice, here:

The Pioneer PL12D Turntable

https://www.facebook.com/groups/1800061146950818

Update 2022

An enterprising gentleman in Sweden, Tom Silvennoinen, is selling new replacement rubber mounts made of modern silicon rubber and cast to the right size, and are a fair price. I know from the PL12D facebook group that these are excellent and remove the hum completely. I'll leave in the section below describing how I restored the originals, but for best results try these:

link to new silicon rubber mounts