Hammarlund Pro-310 Service Notes

By
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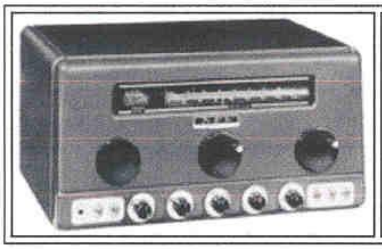
Last update 8 Jul 2004

Note: This is a valuable resource for anyone working on or restoring a Pro-310. The original e-document was posted on Grant's website, but was unfortunately lost to file heaven. This document is a scan of a printed copy of the e-document, so the format is not perfect, with occasional page breaks occurring mid-way through a picture or text, and artifacts from my printer. Otherwise, the information is complete. Thanks to Grant for writing this interesting and essential journal of his odyssey to restoring the '310, and for his permission to reprint it in this form so that many of us can benefit from his work.

Tom Rousseau, K7PJT, 17 Mar 2011



The Hammarlund PRO-310 Project

I recently acquired a physically nice Hammarlund PRO-310. This is a relatively rare Hammarlund receiver, only some 1000 being made between 1955 and 1957. Some seem to think the PRO-310 was designed to compete in some way with the Collins receivers of the time. That seems unlikely to me. It appears much more to akin to the National HRO's in many respects, as Jim Garland states, although different in design philosophy with full bandswitching, a unique mechanically operated, calibrated bandspread-anywhere arrangement, and a 52 kHz IF. It is very different from commercial/military or amateur Collins receivers available in the mid 50's. An excellent description (as well as beautiful example) of this receiver can be found on Jim's website here.

The Hammarlund brochure for this receiver is available at the Hammarlund Historian website. Very interesting ....

While the receiver looked good with average cleanup required, it was immediately apparent that there were some problems -- neither the Main nor Bandspread (called "Scanspread" by Hammarlund) tuning controls changed the pointer positions. Turn the knobs all you want, the tuning was stuck where it was stuck. My initial assumption was that the pointers were simply not moving. I knew the main tuning dial cord had come off the pulleys because I had been given this information by the seller. I expected to find the typical issue of figuring out how to restring dial cord and then all would be well. From an early read of the manual, I had also expected the tuning mechanism to be fully gear driven from the knob shafts to the main tuning capacitor. Not so, as it turns out.

There is absolutely no information in the manual about dial cords. Unusual, I thought. Upon visual inspection of the receiver (still not knowing quite what to expect), it became clear that the PRO-310 is a VERY different beast indeed. Interestingly, the manual contains comments that imply Hammarlund expected adjustment and repair of the tuning mechanism should never be required ... and never is a very long time. Well, at least in this case of one, that certainly was not true. One has to ask whether the Hammarlund designers thought that anyone would still be trying to use one of these things 50 years later, much less have to make mechanical repairs.

From several comments I've received after posting a few queries on the net, it appears that tuning mechanism troubles, especially slipping of either or both of the main tuning and bandspread controls are a common ailment. I'm not surprised

main tuning and bandspread controls, are a common ailment .. I'm not surprised. Actually, I'm more surprised that any of them still work at all, for reasons that will become clear further on.

Then, I said to myself, "How hard could this be? I'll just remove the cabinet and then figure out how to restring the mechanism".

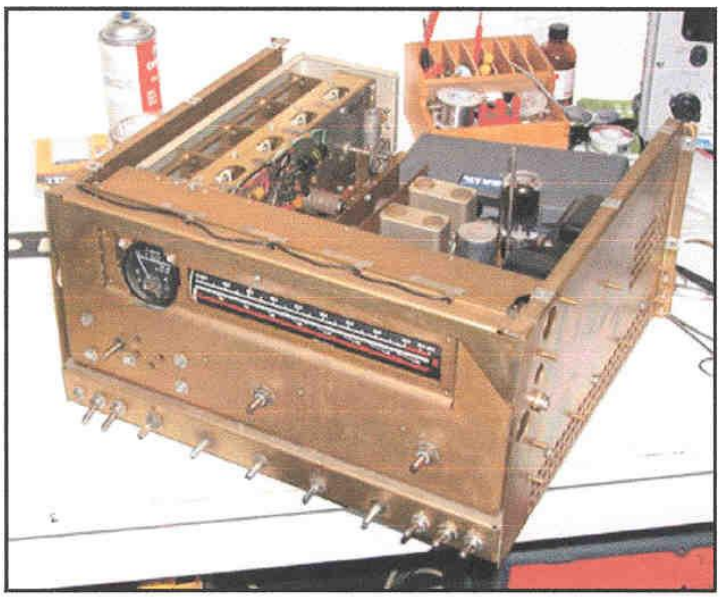
Digging In

Digging In

The cabinet is a five piece affair -- front panel, two side panels, rear panel and hinged top as a unit, and a bottom plate. I'd call it "skins" rather than "cabinet". It comes off relatively easily, and, as I found out, is the only "easy" thing about the radio.

Generally, when one removes a receiver from its cabinet, one finds most major subassemblies pretty well exposed. There are exceptions, of course. The PRO-310 is the exception to the exception. The cabinet is a decorative skin that simply encloses what I can only describe as a heavy, daunting, seemingly impenetrable enclosure that wraps around and seals off access to and view of most of the parts of interest. In other words, removing this outer cabinet exposed virtually nothing of immediate value. And in particular I was no closer to getting into the tuning mechanism than I was before I started. I could see limited elements of it, but I could see those things before the cabinet came off. Actually getting into it turned out to be another issue entirely.

Outside of the skins, this is what the PRO-310 looks like:

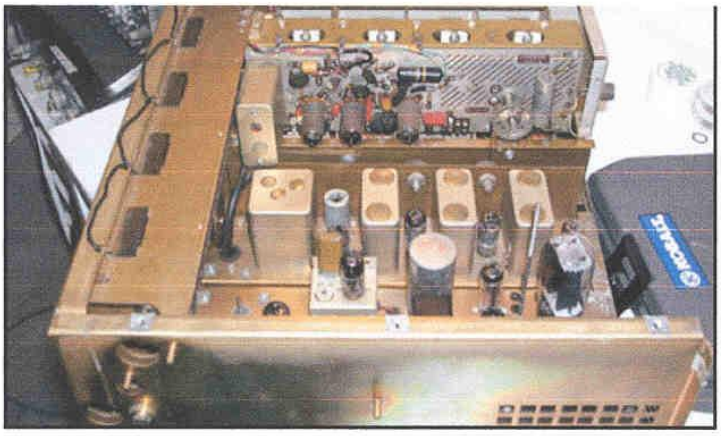


The side panels are welded to a solid L-bracket that goes across the front top of the receiver, and also are welded to the bottom assembly where the various controls are attached.

The center section of the front panel is where much of the tuning mechanism mounts, and it is solidly attached to the tuning capacitor and turret assembly that occupies the entire left side of the radio.

From the side you can get further appreciation for the bastion of metal that encircles the receiver:

At the top of the image is the capacitor and turret assembly (located under the capacitor),

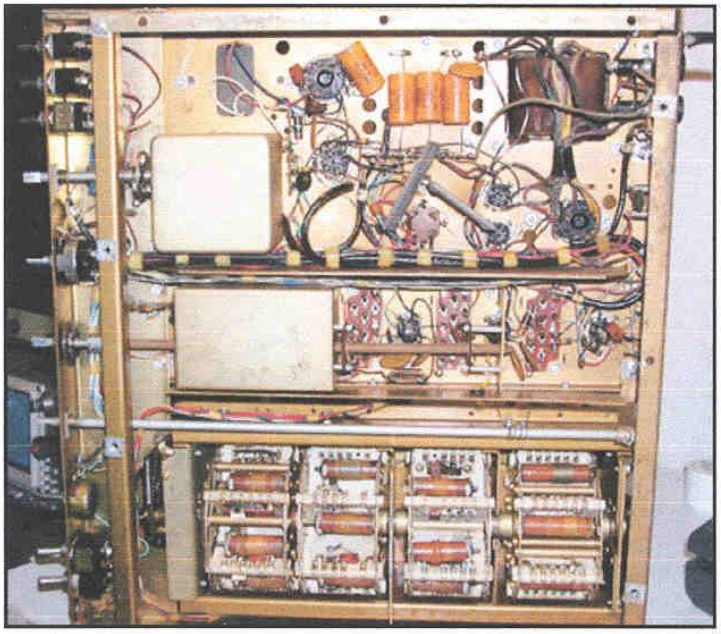


with the printed circuit front-end attached vertically to the side.

Still can't see the tuning mechanism. The horizontal plate that runs across the front of the radio, and extends back about 2" is integral to the front panel subassembly and can't be simply removed. It adds rigidity, holds the four dial lamp clips, and just gets in the way of everything.

The IF strip runs down the center of the radio, front to back, and the power, audio, detector and other circuits are closest to the bottom of the picture .

A look underneath sheds a bit more light:



You can begin to detect some modularization. At the top is the audio/power/detector chassis. The IF strip is in the center. And the bandswitch turret is at the bottom

It is also possible to see a little of the tuning mechanism, dial drum, etc., but not enough to be terribly informative:

The two flywheels (one behind the audio output transformer on the left, and one behind the IF can on the right), are for the main and bandspread

tuning. The fingers just don't fit in there. These have integral pulleys that drive the dial cords for tuning.

By this time, I had the loose dial cord in my hands. It is a continuous loop (no springs, or attachment loops, etc.) and about 0.1" diameter cord. This is no ordinary dial cord, and not one that is off the shelf as a replacement, either.

The bandswitch mechanism and capacitor gear train are totally buried in metal on the far right, in front of the capacitor assembly, not visible in the above photograph.

Kit Making - Part I

Kit Making -- Part I

Notice I did not say "kit building". This is the beginning foray into turning this PRO-310 back into a semi-kit.

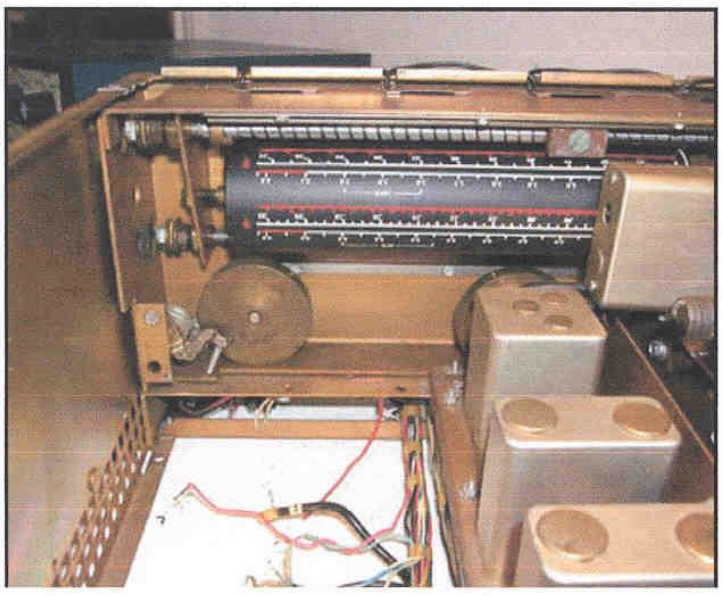
The receiver is divided into four (4) major modules:

1. **Frame** -- side panels, lower front control assembly, other bracing
2. **Power** -- and audio, detector, AGC, etc.
3. **IF**
4. **Tuning** -- front end, 1st conversion oscillator, gear train and front panel display

I initially considered removing the Frame assembly, but quickly discovered that it also supports the other modules. Even if the Frame could be easily removed, I also found that it would take with it the supports that protect the tuning turret. What I needed to get to was the Tuning module. It appeared to me that the Power and IF modules, if still in place, would impede removal of the Tuning module .. they're just in the way. And because of the L-bracket that extends across the top front of the radio, there is no way to lift the tuning assembly up and out.

I finally decided to remove both the Power and IF modules. The immediate benefit is that this would expose the main and bandspread flywheels, and more of the dial drive mechanism. Of course, there is one large wiring harness, one small harness and some other coax cables between the Tuning and IF units that connect all of this together; and even though the receiver is nicely modular otherwise, nothing is connectorized.

Ok, so the Power module came out first:

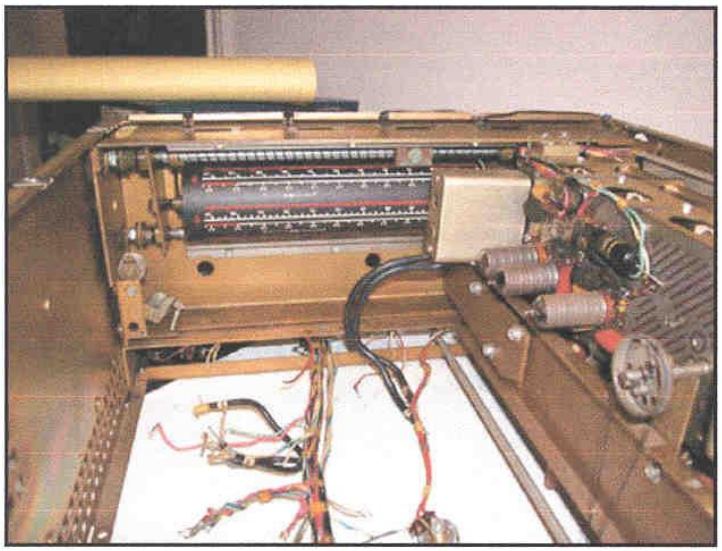


Now the flywheel/pully for the bandspread tuning control is in the clear.

The screw shaft just above the dial drum is for the Main tuning control. There is a follower on this shaft (the object just to the left of the horizontally oriented IF can) that drives the actual dial pointer. This shaft also connects directly to the main tuning capacitor gear mechanism out of

sight to the right. The bandspread mechanism appears to work ok. The follower on the main tuning screw is frozen to the screw, and getting this corrected will be a major part of the restoration work.

Next step was removal of the IF strip:



The IF strip is out, as well as both tuning flywheel/pulleys and the associated panel bushings.

Except for the Frame, everything left that you see in this photo comprises the Tuning module and will come out in one very unwieldy piece. The hard part will be protecting the turret assembly, which will be exposed once the module is out of the Frame.

Working on freeing the wiring harnesses was an unpleasant activity. The 50 year old solder on the joints did not flow well when heated. Even flowing fresh solder on the joints did not help in all cases, and the stuff beat back efforts with both solder sucker and braid to clean the connection points. Too much heat from my variable temp soldering station (which was pretty much any heat) melted the insulation around the wires. The insulation on the center conductors of the coax cables melted like butter. The good news is that the cables are all color coded, and the harnesses built in an orderly fashion such that it was not necessary to put individual wire markers on each lead.

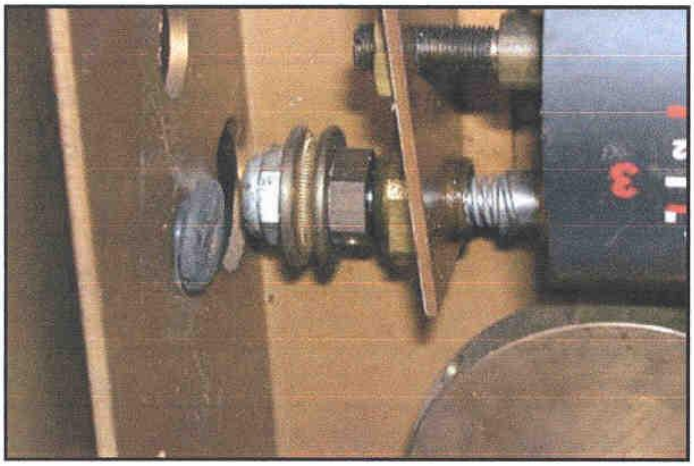
So there's still a lot of cleanup to do in the modules. I'm probably going to replace the coax cables, and rebuild the wiring harnesses with all new or at least spliced in Teflon insulated wire to reconnect when (if) it all goes back together.

Trouble with Tuning

Trouble with Tuning

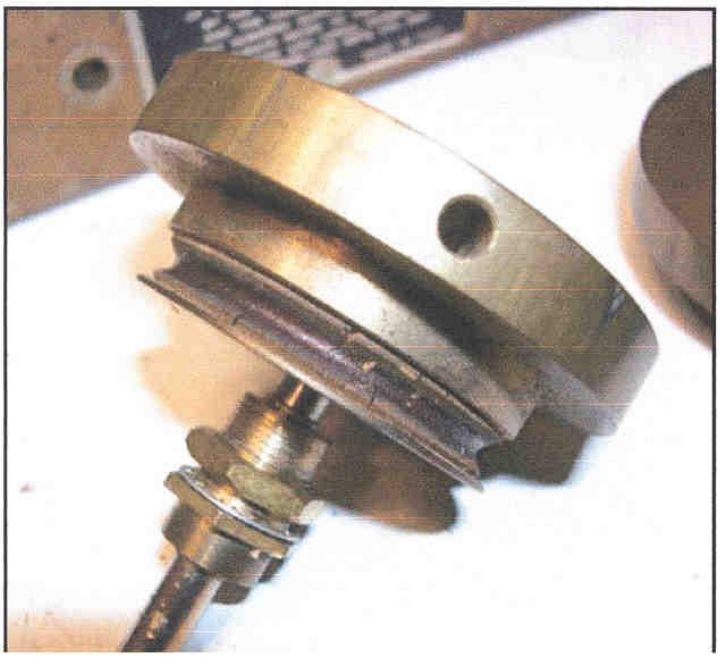
The drive arrangement between the tuning knob and the screw shafts is relatively simple. The appropriate cord goes around the pulley on the flywheel, does a quarter twist across a pair of spring loaded followers, and then up and over the pulley on the end of the respective shaft.

Here is a close view of the pulley on the bandspread tuning screw:



Note how the bottom of the groove in the pulley is ridged. This ridged surface provides increased friction between the dial cord and the pulley since there is quite a bit of effective mass to be moved when the shaft is rotated.

Here is what the main drive pulley on the flywheel looks like:



This is the flywheel and panel bushing for the bandspread control. There seem to me to be two problems here, one which is fairly obvious, the other not so.

First to the pulley itself. There is an insert in the pulley groove, which I believe is most likely rubber -- uh .. WAS most likely rubber. The rubber material, like the grooves in the pulleys on the tuning screws, was a means of increasing friction between the pulley and tuning cord to prevent slipping. It's possible to imagine the braided cord surface biting into the rubber insert when the knob is rotated.

Age, heat and general bad luck have deteriorated this insert dramatically. It is about the consistency of Plaster of Paris. Cracks are easily seen in this photo. The bottom of the groove is smooth and slick. As a result there is simply not enough friction between the cord and the pulley to drive the rest of the mechanism and it slips -- some of the time or all of the time. So if you have a 310, and the tuning slips, dollars to donuts this is a major contributor.

There is a second hidden problem, somewhat less important. The panel bushing has a Teflon bearing. The bearing is worn considerably, so that the shaft/knob wobbles a good bit. This issue only exists in the bandspread bearing seen above. I suspect the reason is that the bearing is relatively short (about 0.5"), and over time the weight of the flywheel on the shaft caused uneven wear on the lower weight-bearing surface. The main tuning bearing is quite different -- about 2" long because of the difference in placement of the two flywheels relative to the front panel. The longer bearing was able to support the shaft more effectively and withstand the weight of the flywheel, and so has not worn to the same extent.

Getting all of this working smoothly and reliably again will be a challenge.

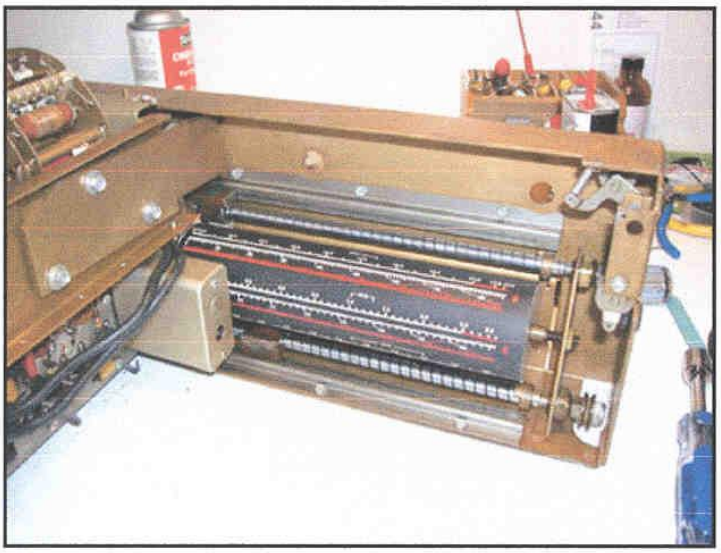
- The rubber flywheel inserts are completely shot and provide insufficient friction.
- The entire tuning mechanism, including the as yet unseen differential gear drive for the tuning capacitor, needs to be accessed, completely cleaned and relubricated.
- New dial cords are unobtainium, and the main tuning cord has a "thin" section about 2" long. I don't want to have to get back in here to do a second refurb, so a new solution will have to be found .
- The panel bearing for the bandspread control should be replaced.

Not to mention assessing and solving the problem of the main pointer follower being frozen on the tuning screw -- which prevents the main screw from rotating at all.

Kit Making - Part 2

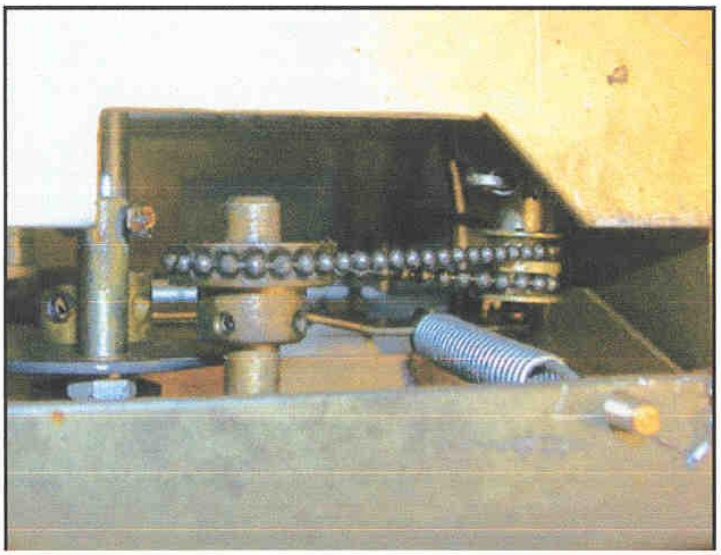
Kit Making -- Part 2

Having gone this far the next step was to get the entire Tuning assembly out of the frame. For now I left the front end circuit board in place and chose to remove the wiring harness from the board which involved just a few connection points. Mechanical removal of the assembly turned out to be relatively straightforward, but does require temporary removal of the rear frame support to slide it free, and several extra arms to keep the wiring harness out of the way while sliding it backwards.



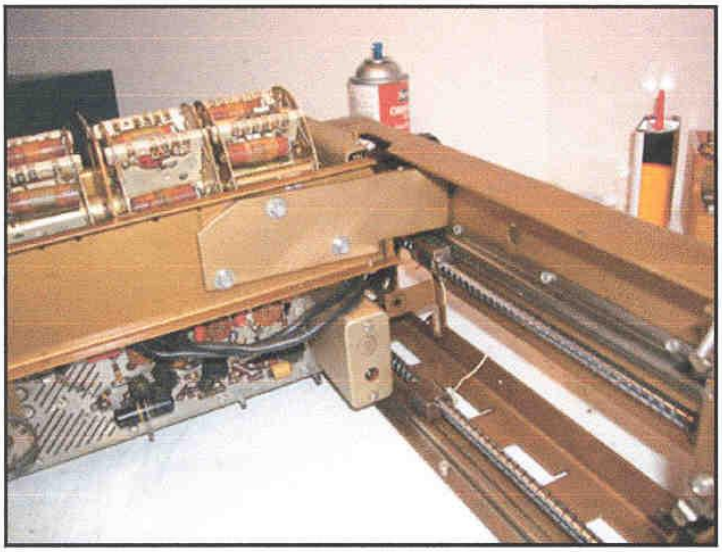
It's sitting upside down, since as I mentioned earlier, the bandswitching turret is now exposed with no supporting structure.

The dial drum connects to the turret and bandswitch mechanism through a fairly ordinary chain drive.



It is only necessary to depress the spring loaded follower (seen here to the right side) to free the chain.

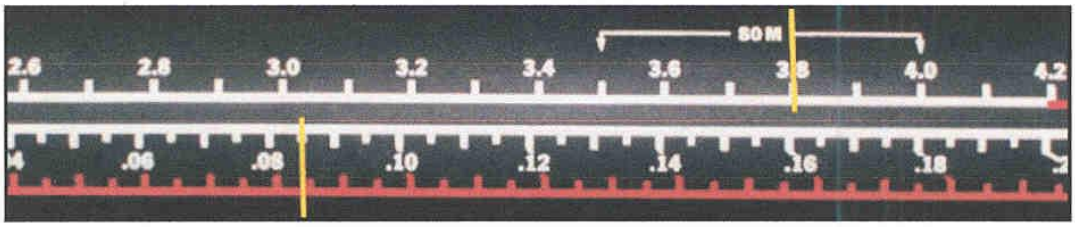
With the chain off the main sprocket the dial drum is free to come out, leaving behind the best look at the mechanism yet .. but still not much.



The capacitor assembly is held to the front panel by the bracket you see in this picture (three screws in a triangular configuration). It is the same on the other side of the capacitor module. The bracket (a U-bracket) is bolted to the front panel but requires removal of the bandswitch control before It comes off individually. There is no other mechanical linkage -- except for the dial drum chain which is already gone, and one shaft/gear that extends into the capacitor assembly.

A Digression

The tuning method in this receiver is unique. It's easier to get a look at the dial scale with the drum removed. This is what it looks like, tuned to 3.885 Mhz (where else!).



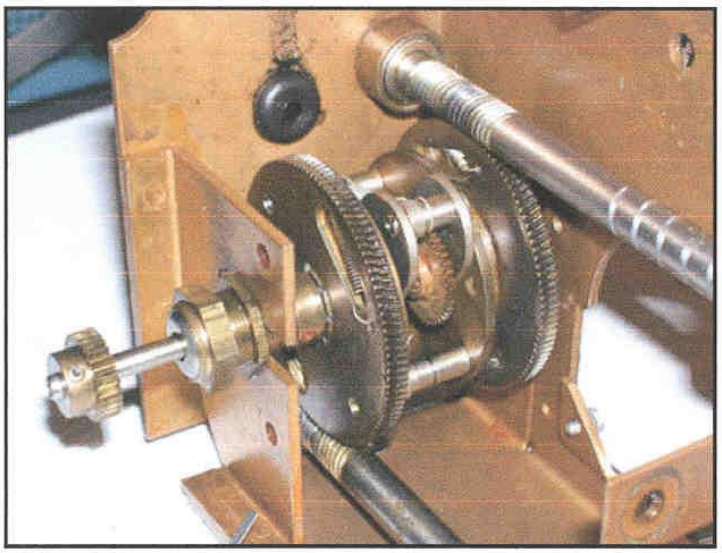
The receiver's frequency is always given by adding together the main (upper) and bandspread (lower) scales. On this frequency band, the bandspread range is 0-0.22 Mhz. So with the main tuning set at 3.8 Mhz the range tunable with just the bandspread control would be 3.8-4.02 Mhz. There is no separate bandspread capacitor as such. All tuning is actually done with the single main tuning capacitor, through the differential gear drive mechanism

The red (lower) bandspread scale is used when the main tuning is set in the corresponding red region, which represents the extreme upper limit of the tuning range in each band.

The drum is painted and silk screened. There's no printed paper overlay to yellow with age.

Back to Work

It's time to remove the capacitor and turret assembly. As a preceding step I used a scribe to carefully mark the positions of the capacitor and dial in hopes of someday getting it all back together where it belongs. Once the bracket is loosened the capacitor unit just slides off.



And *finally*, here is the infamous differential tuning mechanism. This is upside down, so the main tuning screw is on the bottom.

The main tuning gear when turned by the screw, rotates the small gear and drives the capacitor on a 1:1 basis. The rear bandspread gear provides a 10:1 reduction ratio.

The tuning screws and gear mechanism are pretty gunky with ancient lubricant. All of this needs to be thoroughly cleaned and lubricated with a high quality, long lasting lubricant.

The final issue at this stage was attacking the follower on the main tuning screw which, you may recall, was more or less welded in place. I removed the main tuning screw and soaked it for a day in penetrant. Finally after several tries it came free.

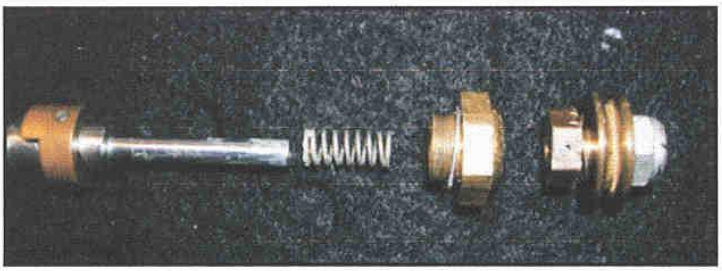
I still don't know for certain whether it was a small amount of rust buildup or just old grease that had turned to a solid epoxy-like mass. There are some small marks left behind on the screw, which should polish out with a little jeweler's rouge.

More Tuning Details .. and some early results

Tuning Lead Screw

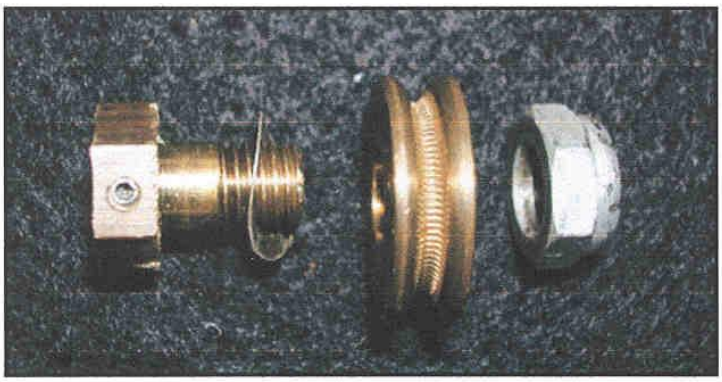
The end of each tuning screw is supported by a simple bearing at the end nearest the reduction gear. The screw has a short pin on the end which simply slides into this bearing. Removal of the screw requires removal of the pulley assembly and a threaded bearing at the opposite end. The screw is spring loaded at the pulley end to hold it in place against the opposite bearing.

These are the piece parts at the pulley end:



The long pin at the shaft end passes through a threaded opening in the chassis bracket. The threaded bearing screws into the bracket and forces the spring to hold the screw in place against the bearing at the far end. The pulley assembly at the right then fits over the long pin and in held in place with two set screws. The stop for the pointer follower must be loosened and slid to the left (in this picture) on the screw to allow the screw to be pulled through the opening in the bracket far enough for the pin at the far end to clear the bearing.

The pulley assembly itself consists of several pieces:



The pulley is held on the fitting between a spring washer and nut. I believe the point of this is that the nut should be tightened just enough for the pulley to rotate the tuning shaft in normal travel without slipping. When the pointer follower hits the end stops, I suspect the pulley is supposed to rotate against the spring washer.

The upside is that this will allow the knob/pulleys/cord to continue to rotate without the risk of wear damage to the braided tuning cords. This could result if the pulley on the screw actually locked in position at the end of pointer travel and the operator

kept cranking away on the knob. The downside is that if the lock nut is not quite tight enough this becomes another potential source of slippage in the tuning mechanism, aggravated by old thickened grease and high friction in the mechanism.

Some good news, though ... It is possible to adjust the pressure of the pulley against the spring washer without complete disassembly of the radio. It is necessary, however, to partially remove the cabinet to access the lead screw end through openings in the front sub-panel assembly. I suppose in the extreme one could just snug it up tight and take some care when the pointer reaches the end of travel. The fact that this is one of the few mechanism adjustments that can be made post assembly leads me to think that Hammarlund expected this might need tweaking from time to time to keep the radio operating properly.

Pointer Follower

The pointer followers are driven by the lead screws and ride a metal track to hold them in the correct position relative to the tuning scale.

I have NOT removed the followers themselves from the lead screws. If these are similar to modern lead screw/follower mechanisms, they likely have races of very fine ball bearings internally and I am unwilling to risk another potential ball bearing disaster.

The followers are held against the metal track with a pair of small springs and ball bearings. The pointer itself has an extended metal plate on the rear which holds these bearings in place and finishes the "clip" that fits over the track. One of the ball bearings got away from me during disassembly, and after several hours crawling around the room with a flashlight and magnet hunting for it, I gave up and bought all new 1/8" chromium steel balls from McMaster-Carr.

Differential Gear

Removal of the differential gear is simple, requiring only loosening of the threaded front shaft bearing assembly (seen in the close-up photo on the previous page). It comes out as a unit.

One *word of warning* to anyone else going this far with disassembly ... the rear of the gear assembly is supported by and rides on a single bearing ball which sits between the end of the shaft and the panel. Not knowing this in advance (you can't see it), I

the end of the shaft and the panel. Not knowing this in advance (you can't see it), I happily removed the gear unit and carried it outside to immerse in degreaser thinking there was simply a pin on the panel end of the shaft. Nearly had ball bearing disaster #2. It was sheer luck that I happened to see the ball drop out of the blob of grease that was hiding it and holding it in place, was able to track it as it bounced across the garage floor, and didn't lose it :-)

The halves of both of the anti-backlash spring loaded split gears were essentially welded together, and the whole assembly was very stiff. Once cleaned and lubricated, it operates much more smoothly, but is still relatively stiff in operation ... more friction that must be overcome by the tuning drive.

When reinstalling, the trick is to tighten the front bearing just to the point where there is no play between the shaft end, ball bearing and panel. The setting is quite critical. A little too tight and things get very stiff indeed.

Early Experiments with Cord Materials

I've had a wide range of suggestions from many people for replacement cord materials, and have spent a considerable amount of time researching the various options for continuous round belts of appropriate size.

The first real experiment, after reassembling the cleaned and lubricated gear assembly and tuning lead screws, was with round, endless urethane belts from McMaster-Carr. These belts are stiff enough that that the spring loaded followers are ineffective in maintaining belt tension. I had also ordered belts about 10% shorter than the originals, since the standard method of tensioning a urethane belt is to use its natural stretch.

These belts did provide totally "slip free" operation without the necessity of replacing the dried out hard rubber insert in the main drive pulley. However, overall operation was otherwise completely UNsatisfactory. Tuning "feel" was extremely stiff, and rubbery. I attribute this to the relative stiffness of the material, the fact that at 1/8" diameter the cross section is about 1/32" too wide and rubs against the sides of the pulleys and followers, the fact that the material stretches too easily when tuning force is first applied, and probably that the material is unsuitable for a minimum pulley diameter of only 1/2".

This was only one experiment with a single material. But, I'm more convinced now that Hammarlund knew what they were doing with the braided belts .. virtually no stretch and no stiffness in the material, and the ability to control tension by selection of the proper spring for the followers.

I had hoped that it might be possible to replace tuning belts with the receiver assembled. The longer tuning cord for the Main tuning drive is easy to install. The Bandspread cord is not. You may be better at it than I am .. but even with everything open, stringing the Bandspread tuning cord is difficult and frustrating. With the rest of the box assembled and in the way, it's just going to be worse.

Nothing ventured .. nothing gained

There are three pieces in the mechanics that I've put in the category of needing complete rebuild or replacement:

1. Teflon Panel Bearing (Bandspread)
2. Rubber friction inserts on main drive pulleys
3. Dial Drive Cords

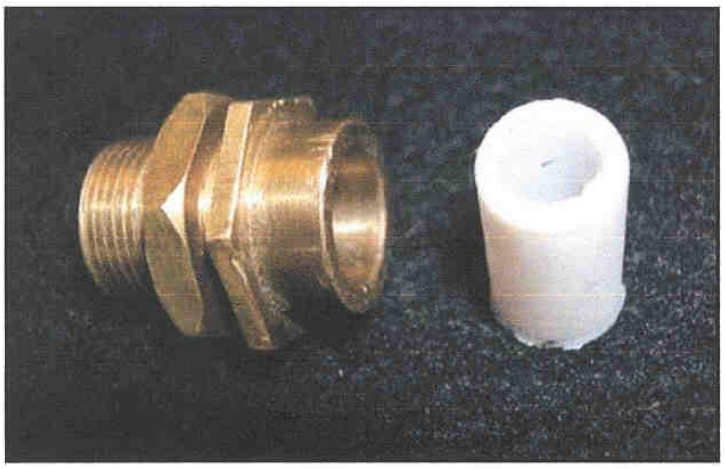
My assumption was that all of these would require one-off custom work at typical high prices for small quantities considering tooling and CNC machine setup, etc. Discussions with a few local establishments that could do custom Teflon machining and molding of rubber products certainly confirmed that assumption on the first two items. This was stacking up to be a more expensive restoration than I originally bargained for.

It was time to take the bull by the horns, and see what was really involved in the Teflon bearings and rubber inserts, even though I would destroy the original parts in the process. They would, after all, end up destroyed somewhere along the line anyway .. might as well be now.

Sometimes you just have to bite the bullet .. and I've always been been one of those people that is never happy until I find out how something works. Just ask my mother how many times she found her prized appliances fully dissected into piles of carefully arranged parts on the kitchen table when I was a kid on a quest for knowledge. I only started ONE fire (in an old Philco cathedral radio), which is a pretty good record :-)

Teflon Panel Bearings

These turned out to be about as simple as you could ask for.



I had to damage the insert to get it out, but it is nothing more that 3/8" O.D. and 1/4" I.D. standard white Teflon tubing.

I cut a new insert, and with a little more careful measurement found the brass bushing to have an inside diameter of 23/64" rather than precisely 3/8". I was able to insert the Teflon,

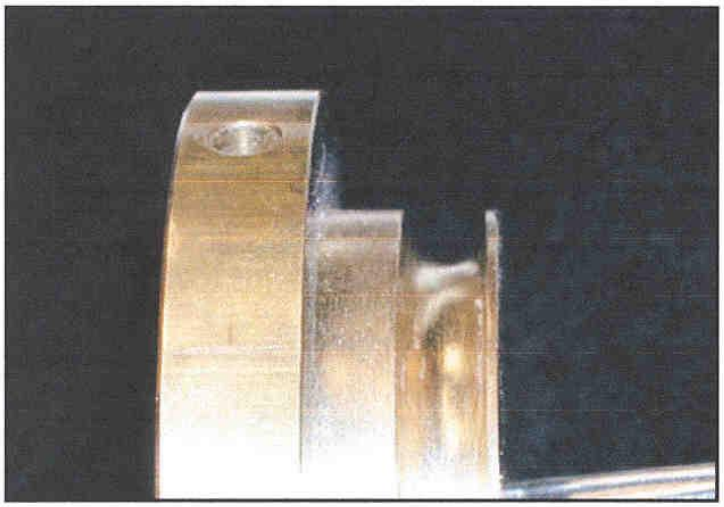
but still had to drill it back out to 1/4" since the I.D. of the Teflon reduced when the 3/8" Teflon sleeve was compressed into the 23/64" housing.

Result? The shaft turns freely in the bearing and the wobble between the shaft and the bushing has been completely eliminated.

Rubber Pulley Inserts

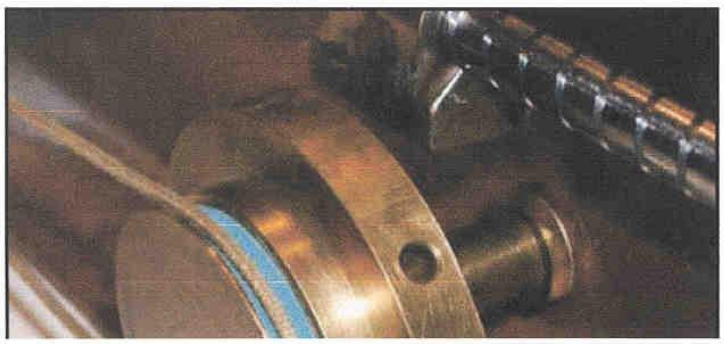
I concluded earlier that the inserts in the main pulleys were custom molded hard rubber. I gritted my teeth, vowed never to look back no matter what, and went after the insert in one pulley with a pick. My original conclusion was incorrect.

The "insert" turned out to be a simple flat band, about 1/4" wide and 1/16" thick, stretched over a semicircular cross section with an extended tangential lip .. in other words, nothing more than a standard round pulley cross section. The rubber was glued in place, and it took a wire brush to remove the very uncooperative adhesive left behind.

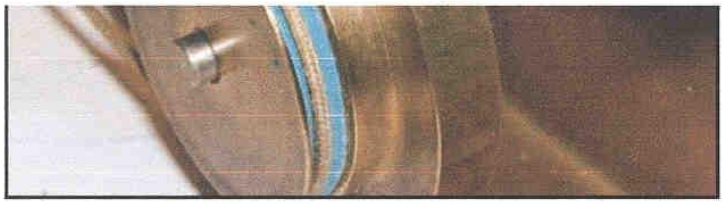


The original band came out basically as crumbs. I believe that as the rubber aged and lost its resilience it gradually took on the permanent form of the dial cord pressing on the center line of the pulley. This gave the insert the appearance of having a custom molded cross section, when in fact it was just a badly damaged "rubber band" of sorts.

To check this out temporarily I used an ordinary household rubber band stretched around the pulley and reinstalled the essential tuning mechanism pieces for testing.



The experiment worked perfectly, with absolutely zero slip between the drive pulley and the tuning cord. If it wasn't for the fact that I'd be afraid the rubber band would quickly disintegrate, I'd just leave it there.



I then tried flat urethane I'd previously purchased from McMaster, but the hardness of the material is too high, and it does not provide as much friction as the simple rubber band. I also had some difficulty welding the ends of the small urethane straps into a stretch band ... and am not inclined to spend $350 for a splicing kit. So I need to find another suitable material.

I was able to set the tension of the small lead screw pulley against its spring washer (see previous page) to provide non-slip drive action until the pointer follower hits the stop. After the follower hits the stop, the small pulley does spin against the spring washer to prevent friction damage to the tuning cord. It takes some fiddling to get the tension right, but it works.

That's one of three major mechanical issues resolved and a second with at least a light at the end of the tunnel. I still plan to polish the lead screws to reduce friction between the screws and the followers to the minimum possible, but the mechanics are fundamentally working properly and the road to getting it all working at least as good as new is clear.

Dial Cord

There is no magic bullet for this one. The bandspread cord is still good, but the main cord is frayed, so at least the longer main cord needs to be replaced.

I have sent that original cord (with great fear that I'd never see it again ...) to the one supplier I've found that can still produce endless braided textile drive cords. Presuming I can get them made at all, and at anything approaching an affordable price, I'll try to make some spare sets available to other PRO-310 owners at cost.

Tuning Fix

Tuning Fix

Pulley Friction Insert

A good friction insert in the drive pulleys is THE critical factor for slip free tuning.

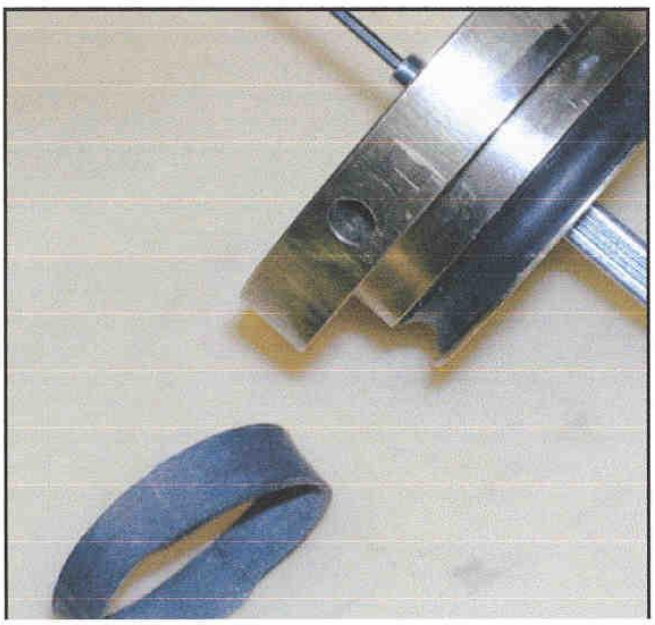
I now have a very large bag of natural rubber sheets in various thicknesses, tubing (cut in cross section), and some other items. Everything worked well, but had installation and other problems of one kind or another. Most adhesives I tested to affix the rubber in the pulley groove was too messy, didn't hold well, or damaged the rubber itself.

The first weapon I ever possessed was a "rubber band" gun my dad and I built when I was .. I don't remember .. VERY young. I think the plans came from either Boy's Life or Popular Mechanics. It was a reasonably substantial weapon. The rubber bands were 1" wide rings cut from truck tire inner tubes.

It occurred to me that the biggest problem with most of the materials I had available was that they had to be glued to the pulleys. A rubber "band" would not require adhesive to hold it in place if it had just enough stretch. I had, by the way, tried creating natural rubber "bands" using glue and vulcanizing compounds, with little success.

One thing led to another. A trip to the sporting goods department at Target, and I came home with a standard 1.75-2.25 butyl bicycle tire.

The result looks like this:



The measured temperature (thanks to John, K7RLD) in the sub-front panel area is about 100 deg. F. The butyl rubber in the tire tube material should easily be able to handle that.

The real question is overall durability. The good news is that since no adhesives are needed to hold these "bands" in place, they will be relatively easy to replace if/when that is needed. More good news is that there is no end to a cheap source of material. Other material types are also available in

mountain bike tire tubes -- including Latex and butylized Latex.

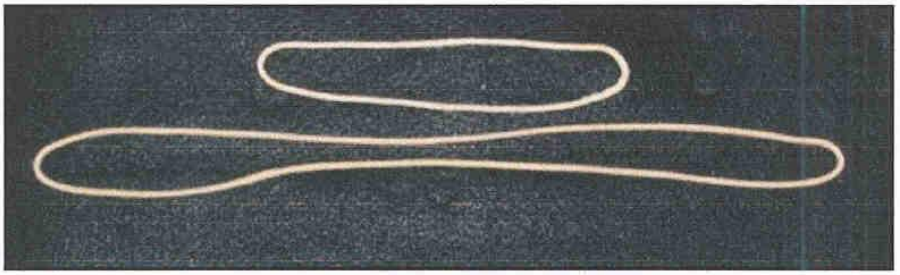
The best news of all is that it works very well. The rubber should be cleaned thoroughly with soap and water to remove the talc on the inside surface and any grease. The inside surface is also a bit more rough, so after cutting and cleaning the band, turn it so the inside is the outside. It's important not to nick the band material laterally when cutting, since it will be prone to tear across the band width under the stress of stretching.

I can't try it since I have removed all of the original dead rubber from my pulleys, but I suspect you could simply slip one of these bands over the existing material on the pulley to cure a slippage problem without much effort.

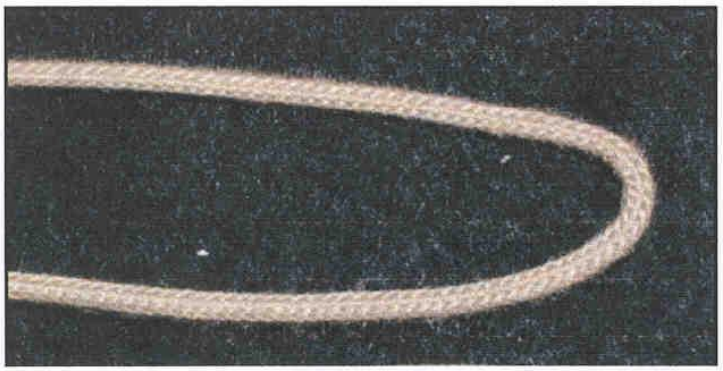
Dial Drive Cords

Most PRO-310 owners that I've corresponded with have drive cords that are still serviceable. One of mine was severely damaged from excessive friction wear.

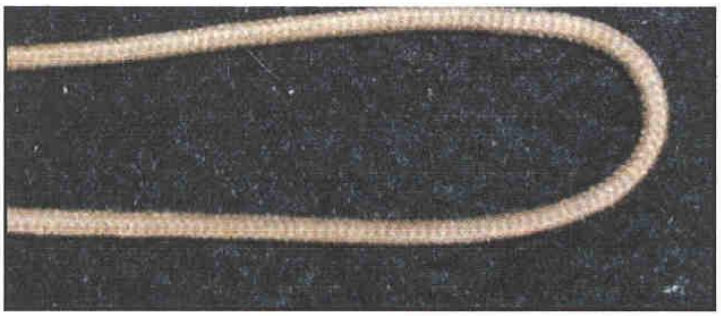
I found one manufacturer in the US that could still fabricate something equivalent to the Hammarlund originals. That company is Belting Industries Company in Kenilworth, NJ. I now have sample versions of both of the new cords.



They are for all intents and purposes identical to the originals. In the picture below, the new cord is on the top and the original Hammarlund cord is on the bottom:

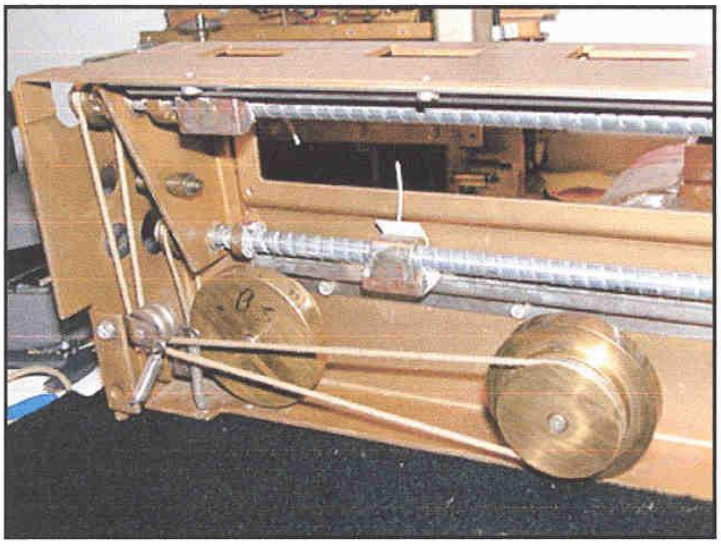


The new cord is just lightly larger in cross section and the braid is not quite as tight as the original. But the cord, once tensioned in the dial drive, has virtually zero stretch (the key criteria), fits all of the pulleys, and ... well .. works! There is no



functional difference from the original.

Here's a shot of the new cords in the dial drive:



I did have to replace the spring on the main drive tensioner because the original was badly stretched. The new spring is a standard ACE Hardware variety. I lost track of which springs (bought several to try) came from which bag .. so I'm not sure which spring number this is. When I can, I will get back to the hardware store, verify the spring number, and add it here.

I am having a small run of cord sets made, and will make them available AT COST. If you are interested and have not previously responded to my postings on several boatanchor e-mail reflectors, send me a note.

The mechanism -- with the new friction inserts, cords, and cleaned and lubricated gear train -- operates very smoothly and most importantly, does not slip.

What's Next?

What's Next (as of 7-8-04)

The new manufacture dial drive cords are in, and have been shipped. I do have a very small number of extra sets (four sets as of today). If you've happened by this web site and would like a set, just drop me a note for the particulars. Once the small stock I have is gone there will be no way to economically have any additional cords manufactured because of minimum order charges -- unless another large group of people who want cords turns up unexpectedly.

I am also planning to have a slotted alignment tool of the correct diameter made. If I'm successful in getting something fabricated that works well, I'll look into having extras made for anyone (probably most) that need one. No forecast on that yet, however.

I have finally gotten back to the rest of the cleaning, restoration and reassembly process. More to come.