Mark VII Motor Reassembly

Starting with the armature. I am not sure of the correct placement of the plastic washers/shields. They may have been intended to be on the outside of the bearings to act as a dust shield. I placed them as shown in the second pix. AIRI that was where one of them was. I am not the first to be into this motor, so as found is suspect anyway.

There is a goof here. The output bearing retaining collar is missing. I had to later remove it all(press off/press on) to add it to the mix.

Pulling the output bearing on was pretty straight forward. There are two gotchas on this armature shaft though. The ends of both shaft ends are 5/8" which is slightly smaller than the shaft at the bearing id location. Make sure the bearing puller is open sufficiently to clear that part of the shaft.

Setting up for the vac end bearing was problematic.

A crude 'solution' but it worked. I have since acquired 3/8-16 couplings for the 'extensions'.

The armature fully assembled(sorta-the retaining ring is still absent)

The start switch board mounting hardware includes 3 washers between the board and the end cap. The lock washer and nut are in depressions on the outside of the cap.

The start switch and end cap bearing spring are lubricated with lithium grease. The washer goes in the cap cavity before the spring. Lithium grease is what I have on hand.

When replacing the vac end cap, do watch for pinched wiring.

Finally align the end cap and motor shell 'scratches'.

As mention previously, this should not be left over!

After removing all that output end stuff and adding the retainer and repressing etc., it can be used to attach the output end cap. Screws from the outside resting in depressions also.

No pix, but the long screws that secure the end caps to the shell are added next after aligning the output end cap with the 'scratches'.

Now what to do about the rubbing sheave.

After simmering for a week(two?) I finally decided upon the 'fix'. Since the groove was close to the shaft od, the fix needed to be 5/8" id. It also needed to be thin so as to not space the fan sheave out from the motor.

The 'fix' was a 5/8" retaining ring. It is only about 0.030" thick.

So next the fan sheave is attached and the set screw very tightly secured. I think they stay if the set screw is secured properly and sufficiently tight. However a little blue locktite won't hurt. The key must be located so the set screw gets a good bite onto it.

Next the floating sheave is installed. A liberal application of oil at this time is proper. I have my misgivings about the PO's alteration.

Spring and cap ready to be compressed and secured with the retaining ring. I am fortunate to be able to do that with only the retaining ring pliers for tools. Trick is to never let go until ring is fully seated. If plan goes south, release spring tension slowly!

Motor itself is essentially done, but this model has much else in/attached to the motor pan.

The 'front' of the motor pan has a model plate, key lock, and the power/direction switch mounted to it.

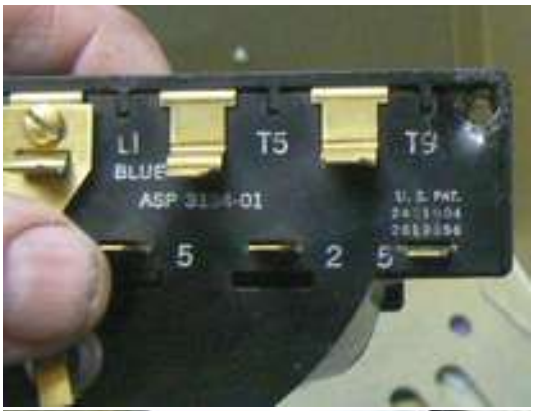
The model plate is secured with two small screws. Shopsmith Inc. and RLF Tools Inc. are not the only ones that confuse model 'numbers' with both Roman numerals/'Arabic' numbers. At least they did not include **both** on the same unit as Magna America did! The plate says "7" but everywhere else it is referred to as a "VII".

The lock has two flats that prevent it rotating in the double d shaped hole. The moving part also has double d flats.

The cam plate is secured to the lock core with a nut. A wave washer spaces the plate away from the lock base. The nut must not be over tightened or the lock core will not rotate.

The cam plate rocks under the switch button shafts. The cam plate end must be rotated out from under the switch shaft to allow the switch to operate. This pix shows the cam plate in the off/locked position that prevents both the forward and reverse switch buttons being depressed. It also shows the plate 'offset' facing the inside.

Got lucky! Got both original keys! Third one is a copy and will be the 'active' one. The lock is shown in the forward run position. The cam plate is rotated so the forward switch to the right can be activated.



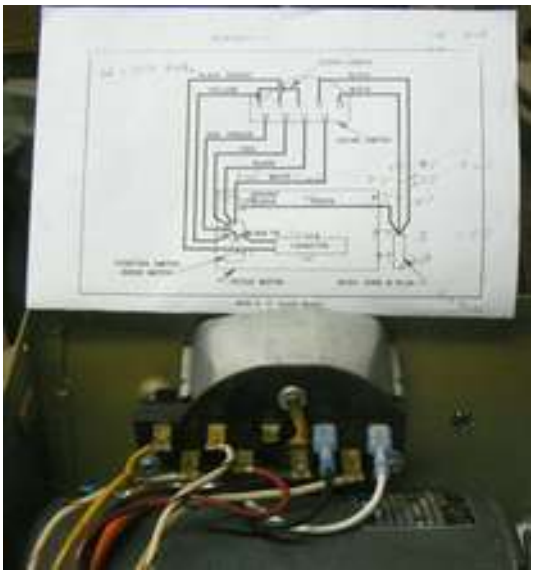
Moving on to the power/direction switch. The power switch mounting holes were deformed by the mounting nut.

I added a flat washer under the nut. The switch is mounted on spacers and two screws. I have since added ext tooth lock washers. I had hoped to find kep nuts, but with no hardware store near by.

Front view of mounted switch. You can see the cam plate in off/locked position.

Last a hole plug.

At last we mount the motor. The Mark VII differs from the Mark 5/V as the mounting brackets use 2 of the 4 screws on the front. The screws are still #3 Phillips.

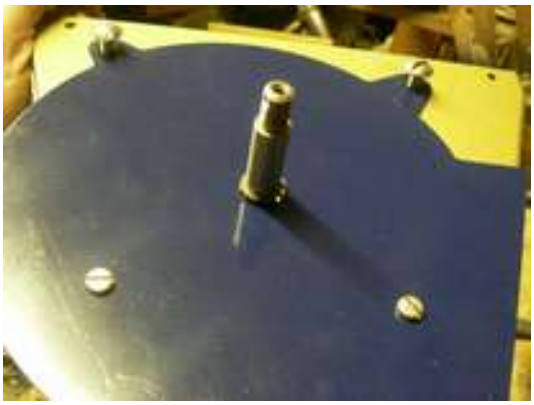


Connecting the motor wiring to the switch. A jumper is hiding someplace in this state. I may have to make another one.

Motor on and running in reverse. Note the 'iluminated' button.

Moving on to the 'vacuum' etc.

The motor shaft extends from both ends of the motor pan. This is the 'front'(towards tailstock end). The shaft dings were 'provided by a PO to I assume settle down a wobbling impeller(makes taking it on/off almost a pita). Step one reattach the retaining clip that serves as a stop on the shaft,



The vacuum blower base is essentially a shaped flat plate.(I did not have any **black** paint). The large screws are started only to provide positioning at this time. The smaller screws are tightened down.

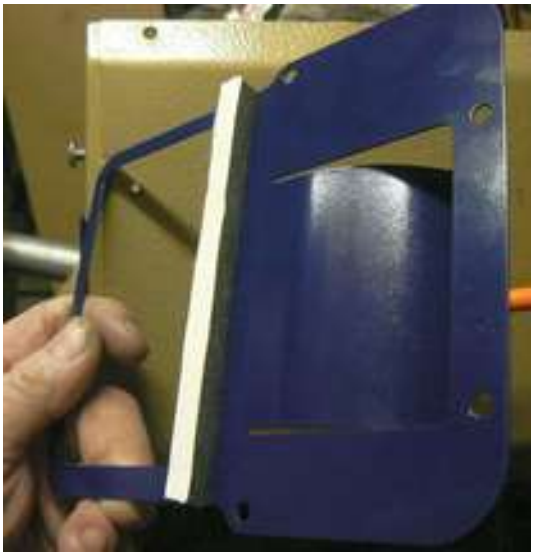
Next comes a flat washer on top of the stop ring.

Then the impeller.

Then a smaller flat washer and ext tooth lock washer.

I does not show in the pix, but, the shaft at some time was dropped and the very end of the threads were slightly mangled. Had to chase the threads on both the shaft and the nut(since I first tried to force the nut on). 3/8-24.

After cleaning the threads, the castle nut is screwed on and a cotter pin inserted through a 'slot' in the nut and a hole in the shaft. The long end of the cotter pin is bent over to hold it in place. The original cotter pin shown will be replaced with a new one.



Weather stripping is used to prevent air leakage between adjoining parts. This is a deflector plate that directs the air flow to the output port. I used weather stripping that I already had. It is too stiff and will be replaced with a softer foam type. When it all is tightened down, the plastic parts became deformed under the screws etc.

I do not know why the crooked flow path unless the blower needs slight back pressure!

More weather stripping on the output port housing. My hand shows through the output port. The 'plug' is to the right.

Housing attached and tighten down with three sheet metal screws into the motor pan. Notice the deflector mounted under the housing. Also the gold 'plug' is removable(friction fit). Not sure if removal was intended, but added paint helps 'secure' it!

A fourth screw uses a tinnerman nut.

And finally the impeller housing.

Not shown, but the large screws used to position the plate are removed and used to secure the top of the impeller housing.

Three clips secure the housing to the lower portion of the base plate.

Since taking these pix, I realized there are two differently shaped clips. The ones with a straight back are used for the three locations around the housing.

More clips are used to secure the housing to the deflector plate/output port housing. These clips are slightly bent on the back. Again the pix are showing the wrong clips.

A leak indicates a need for sealing between the base plate and the impeller housing.

Front right view.

Rear left view.

Not detailed is the power cord. I used #16-3, but kept the length short(about 3'). I will use a larger wire size extension cord with it.

I chose that size so the original Heyco clamp(black plastic thingy) could be used as a feed through strain relief(same as oem cord). The inside end of the power cord wires were terminated with two 1/4" female faston terminals that connected to the power/direction switch and a ring terminal on the ground wire attached to the motor with an external tooth lock washer between the terminal and the motor shell.

The power switch buttons had the original lettering worn almost completely off. I had them laser 'engraved' at #Woodcraft and filled in with black paint.

I gave up the 'search' for the original jumper and made a new one. I will likely insulate(tape) the exposed terminal (yellow wire from motor).

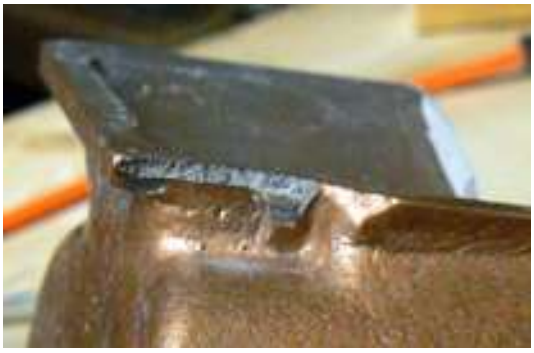
Well 'it' reappeared. Both ends are female terminals, but the one on the left also has an extension that provides a male terminal for the motor wire to connect to.

So, It is back to the 'original' jumper.

Well as a result of it being both idle and 'unattached' to the headstock, it became an insulation blower. Unfortunately it sucked up a nail and made some very disturbing noises.

The result was a couple of 'fractures' to the fan housing.

This one looks scary, but was easily 'fixed'.



This one was the area which was previously damaged(so no surprise).

I recalled the problem I had with the paint disolving the plastic, so I tried the purple pvc 'cleaner/primer'

I may hit it with more paint.

On to Problem 2.

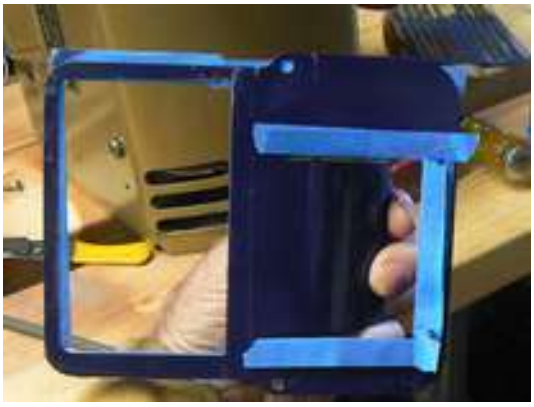
Built it up with jb weld. Several 'coats' due to running. Not sure that is a good thing.

Did not duplicate the 'notch' for the retaining clip(it got lost anyway).

Well I changed my mind!

I decided to steal a clip from the other side and make that repaired side 'clippable'.

Crudely ground out the jb weld with a small cutoff wheel., and filed a groove for the clip. Not pretty, but functional.



I also decided to seal it differently. The weather stripping was just too thick. This patch did not need the extra stress.

Masking tape with the fold always facing inward(towards the dust side).

Goofed here! Notice the dark triangle. The shroud goes there, not where I placed the tape. Discovered the goof after reassembly. Forced JPW into the crack and crossed my fingers.

And the other ear.

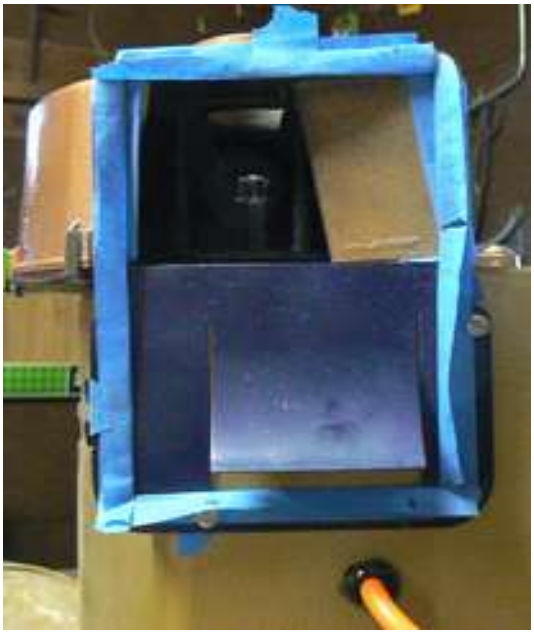


Plate in position for exhaust port housing.

The repaired clip mount at work.

And finally from whence the clip was stolen. There is a screw very close by that diminishes the need for a clip here.

I do hope to not revisit this 'again'!;)

FWIW, the missing clip 'reappeared' so it is now where it belongs(no pix).

Mark VII Headstock Reassembly

Starting with the belt cover.

The Mark VII has some parts not included with a Mark 5/V. It has a way tube gear rack disconnect control. Normally the headstock cannot be moved except by cranking the positioning lever. The disconnect allows free wheeling so to speak(moving the headstock by pushing manually).

Two 'tinnerman' type clips provide captive 'nuts' for mounting the control bracket. Notice the 'extra' square cutout in the front way tube hole. That provides clearance for the gear rack mounted to the back of the 'front' way tube.

The bracket is not flat so it must be positioned correctly to match the slope of the belt cover.

The control shaft is inserted into the bracket bore from the inside.

This shows the cam end of the control shaft. It moves a plate that removes pins from the headstock positioning drive gear thus uncoupling the pinion gear that rides on the way tube gear rack . We shall see that stuff later.

The knob is all that holds the shaft in place. The knob set screw goes on a flat on the shaft.

The knob was slightly cracked, so I applied some CA and hope enough seeps in to keep it in one piece. The knob has a brass insert so that will help.

Finally dere is de hole plug. The Mark VII did not have a vent plate when I acquired it. It will have something eventually.

Mark VII Main shaft reassembly

Build in progress! Much to come! As it all gets done a piece at a time.

Not much to show here. The poly-v pulley is centered between the retaining ring grooves and tight(very) to the shaft at its original location. The retaining rings are installed in the grooves, and the bearings are pulled onto the shaft up to the rings.

Bearings are 25x52x15 sealed.
New bearings from http://www.vxb.com/8-Bearing-6205-2RS-25x52x15-Sealed-p/kit487.htm

Now for the headstock casting reassembling.

Starting with the main shaft, the inner bearing retaining clip is started into its groove.

Then worked around until fully seated in the groove.

The shaft/bearing assembly is inserted through the rear bore, through the poly-v belt and into the front bore.

Notice the front bearing protrudes from the front bore when fully seated.

Mark VII quill feed reassembly

The Mark VII quill feed assembly is essentially the same as a Mark 5/V.

The spherical washer is installed with the concave side towards the casting ear(to the right in pix).

The sleeve goes over the woodruf key. This one is damaged, but I think it will work ok.

The spring washer and lock wing nut are last on the 'lock' side

The return spring housing is positioned with the index aligned as originally.

There is no washer between the retaining clip and the inner serrated washer as is typical for this vintage Mark 5's. The serrated sides of the washers face the lock index dial.

The spring housing is secured by the set screw(not shown in pix - only the hole!)

Finally the wing nut is attached.

The handle(not in pix) mounts the same as the Mark 5/V/7 on either end of the quill feed shaft.

I prefer a 'dowel' and mallet to install the spline shaft coupler.

I had the wishful thought that I would install a new two bearing quill rather than the 'original'. It did not fit!:mad: It was too long and would not retract fully.

I am suspicious of the 'original' quill. It has a blox shaft which is not typical for this vintage. It also appears to have been cut off. May or may not have been by a PO.
I simply do not know what the original Mark VII was.

My suspicions have been confirmed. A subsequent arrival of an actual Mark VII quill has a shorter splined shaft. I have since replaced the cut off one with the 'real' one.

So I will have to back up and refurb the quill that came with it when I acquired it.

The quill reassembly is essentially the same as a Mark 5/V/7. **NO, NO, NO!!! The quill shown here apparently is from a Mark V.**
I have acquired a 'real' Mark VII quill, but have not disassembled it (yet). I will add to this thread at the end when I reassemble it.*

The quill stop ring and rubber bumper are installed on the outside of the quill.

The shaft and bearing are slid into the quill.

The retaining ring is installed.

And finally the knurled collar.

I am suspicious that this quill assembly is not 'original'. The blox shaft and the two part shaft are why. **TRUE! It Ain't!**

Mark VII Quill Reassembly

Well reassembling the Mark VII quill ended up being a bit of a challenge.

The reason for the 'extra' shims became apparent.

Leaving them out resulted in about 0.040" end play of the shaft. This was caused by the bearing seating too far into the quill. That created a gap between the bearing outer od and the retaining ring.

Herein is the cause and the reason for the unexpected shims.

Apparently a bearing had been slipping and wore the quill by increasing the bore depth.

Another problem was the butchering of the shaft flat.

Some judicious hand grinding restored the flat.

I replaced the quill with another of Mark 5 vintage. All that I have are the same on the output shaft end, but Gilmer quills I believe are longer.

The shaft and bearing are inserted into the quill same as usual(including the top hat spacer). The bearing in the pix was what was on the shaft from E-bay. I replaced it with one that seems to have less 'play'.

Add the outer stop ring, rubber bumper and the knurled knob and it is complete. The coupler is slid onto the splined shaft.

This pix shows the difference between the Mark VII coupler and a current version.

An additional difference between quills today and the Mark VII vintage is the id of the quill. Hence the different outer shape of the coupler. Also affecting this is the shorter quill shaft length. The Mark VII coupler goes further into the quill when it is retracted fully.

Mark VII counter shaft/headstock reassembly

Moving on to unique Mark VII hardware. The 'counter shaft' allows mounting the headstock positioning spur gear, clutch and bevel gear. The shaft extends downward from the bottom of the headstock casting. It is probably driven into the casting and wedged there by small splines. In any event, I made no attempt to remove it.

The shaft has three grooves that are for retaining rings.

A clip is installed in the first groove.

The spur gear goes on next. Notice the notches are facing out.

Next the bevel gear and a second clip. As we shall see later, the notches in the spur gear **can** align with the holes in the bevel gear.

Next the clutch and spring. The clutch pins extend through the holes in the bevel gear and into the notches in the spur gear.

A washer and a third clip finish it off.

The clutch is moved by the lever mounted on the belt cover. More about that later.

Mark VII lock shaft headstock reassembly

I call this a lock shaft because it functions as the headstock lock. It also provides headstock positioning.

Crank/lever is reattached to shaft by by a tension pin. The pin is pressed flush to both ends.

Crank 'cover' is secured by three screws. The notch provides later access to the motor pan retaining screws.

The shaft is inserted through the crank 'hub' and a spacer and the front wedge are slipped onto the shaft. The wedge 'flat' faces the rear. The wedges have straight bores(Not threaded).

The spacer in inserted into the crank hub.

The worm gear is slipped onto the shaft. A small woodruff key goes into a keyway in the bore of the gear. The worm gear meshes with the bevel gear on the counter shaft.

Next on the shaft is a long spacer.

A bracket goes over the shaft between the spacer and the gear and the front wedge.

Two short screws secure the bracket. These were really torqued down when disassembled.

Next are the larger flat washer and a spring.

Mark VII lock shaft revisited

I was not satisfied with either the feel(not smooth but grating) nor the locking function. The front wedge was totally ineffective, and the tension needed to be maxed out for the rear wedge to clamp.

Two things were apparent. The 'spacer' and front wedge did not slide in the bore, but were jamming. There were some small burrs caused by dings and wear. The bore had a protrusion that I believe was caused by the screw that fastens the worm gear bracket bottoming out in the threaded hole. After gentle filing of those parts, they moved in the bore with no restrictions.

Even after cleaning that up, the original problems remained. I finally came to the conclusion that the grating was caused by the extreme tensioning. So after much examining, and much head scratching, I concluded that the spacer between the front wedge and the handle 'cam' was worn to the point of being too short. I slipped a retaining ring on the shaft between the spacer and the front wedge. This acted as a shim to effectively lengthen the spacer.

All is now 'better', but the 'shim' dimension is critical. Too thin and it is ineffective. Too thick and the front wedge will not release from the front way tube completely. I will try different amounts to achieve a reasonsable 'compromise'.

I did not take any pix of this 'activity'.

The shim was located between the spacer and wedge in the bottom right in this pix.

Mark VII Speed Control Reassembly

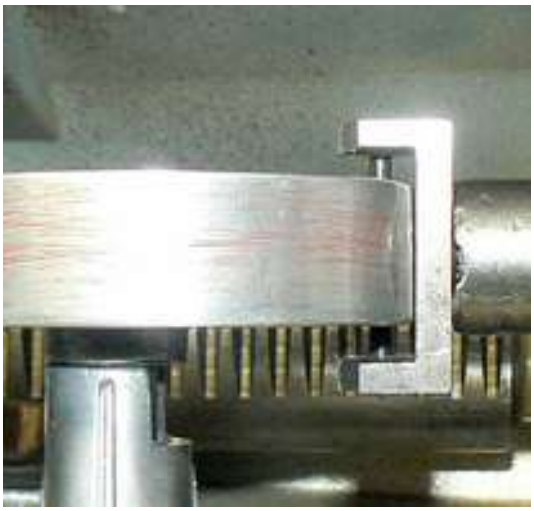
Much of what appears below is correct, but, in the end some major wear issues caused a different method for attaching the control knob to the shaft. I will add a link to a separate thread that addresses not only that 'issue' but some others as well.

The Reeves drive part of the speed control is essentially the same as the Mark 5/V, but the control is different. A cam replaces the pork chop etc. and a large knob replaces the crank. The original had a plastic cam that was its major weak link(many melted). This one had a third party cast aluminum cam. Still does!;) Notice the 'different' screw. Gotta make sure it goes in the hole already boogered by it.

The cam is secured to the shaft by a tension pin. The shaft may be positioned either of two ways(it does not matter which since the hole and shaft flats are not offset). The cam hub notch faces the shaft. The pin is driven flush.

Now a discussion re the cam follower on the end of the control sheave. The opening in the follower yoke is wide to allow for the changing position of the idler shaft when the eccentric is rotated for tensioning the belt. The yoke is also wider in one side(the pivot is not in the center). I believe the wider side must be towards the back side of the headstock(the same as the direction the eccentric is rotated to increase belt tension). EDIT: Ignore the underlined statement above. The follower is 'fatter' on one side than the other. The 'skinny' side faces the increasing diameter of the cam. That would be fat side 'down'. Since the pix are taken from the bottom, you are seeing the fat side.

This pix was taken with the eccentric adjusted to its rearmost position.



This pix was taken with the eccentric at minimum tension setting.

This pix also shows the notch in the control hub. The cam notch and this notch allow the follower to move further towards the shaft at fast speed.

Now for an explanation of how this control works.

The 'base' has two 'bullet' spring loaded detents(brass colored thingeys near the top). The knob has 29 'grooves' around the center. The detents are spaced two grooves apart. Normally the two detents are both in grooves, but at the ends of the grooves, the knob will move one more groove by having only one detent in the 'next to last groove'. This creates 30 distinct detented positions.

The three mounting screws are in curved slots. The base can be positioned for slow speed setting by rotating the base.

There is pin on the knob(6 o'clock in the pix) that rides in a groove in the base. At the top end of that groove is an adjustable stop. This is in essence a high speed stop adjustment.

An extra(it is not shown in the manual) spring washer came with it.

It was originally(as I acquired it) between the knob and the base.

I put it together with the washer 'as found;. The retaining clip for the knob went on fairly easily.

That caused the knob to be pushed out away from the headstock creating a large gap.

So I moved it to between the knob and the retaining clip(made getting the retaining clip on much more difficult!)<<<Not a good move! See post 19 below.

Adjusted for slow setting.

Not sure I like the wave washer where it is. Knob turns hard. Not totally satisfied with limit settings. Time will tell if things stay as they are.<<<<<<<< Nope!

A lot of guessing about the way things 'should' be.

Another thingey not on a Mark 5/V is the carriage to headstock connecting rod. The headstock has a clamp that registers on the rod.

A tension pin stop and a shaft guide are pushed into holes in the front of the headstock from the inside.

The control rod is inserted into its hole in the headstock, then connected to the latch and the latch is placed onto the shaft guide.

The screw, washer and lock nut loosely secure the latch.

The rounded end of a spring is inserted into the control rod hole in the latch.

This pix is wrong, see below.

The other end of the spring sits in a small 'well'. Looks weird, but works quite well.

Pesky detail, but, the spring is not inserted properly in the last two pix. See below.

And the tinnerman nuts get us prepared for mating to the motor pan etc.

The operation of the clamp will be come clearer when the carriage is done.

"below"

The spring goes to the hole above the linkage, not below as shown(wrong) above. In the two pix below the spring is on the opposite side of the linkage(sorry the pix are reversed, but hopefully you can see the difference).

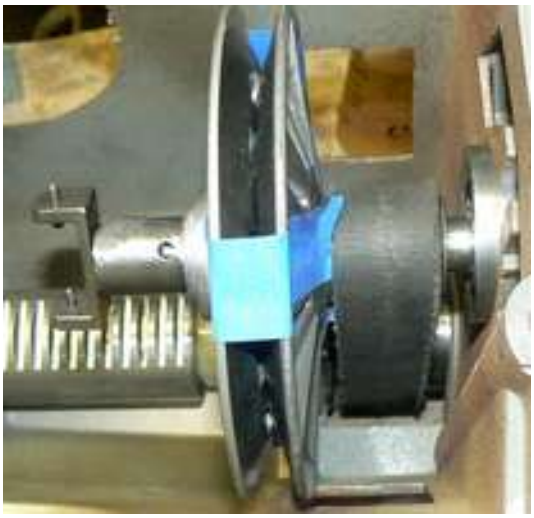
In spite of my previous comment re its working well, this makes it better!

Mark VII Idler Shaft Reassembly

Wear problems caused some changes to the assembly of the parts below. A separate thread addresses those changes. That thread is the same as the one mentioned above. I will provide a link to it here also.

The sheaves and key slide together with nothing securing them. The key is like the Mark 5/V with a 'hook' end that nests into a shallow bore in the idler shaft.

The assembly is slipped through the poly-v belt and into the eccentric bore.



I taped the sheaves to prevent the control sheave from sliding off.

The stop screw and washer prevent the eccentric from sliding out the bore as well as positioning it flush with the casting.

The eccentric is then secured with the screw, lock washer and nut.

The eccentric is rotated to provide proper poly-v belt tension(about 1/4" deflection when pressed from the side.

The screw is tightened to just fully compress the split lockwasher.

As I mentioned above, the speed control knob has become way too stiff(difficult to turn).

So I revisited it and gained a better understanding of some 'details'.

The slow/fast extremes are limited by some simple 'details'. The cam cannot push the control sheave any further than its very end will push it, but the sheave will bottom out against the idler sheave before that occurs(even though the idler sheave can also move on the shaft). The cam follower is limited in the other direction(fast) by its interfering with the control shaft.

The control knob has another 'set' of details. The indications around the dial are fixed relative to that 'stop' pin on the back side that rides in a groove. That groove has a 'slow' end that limits dial movement. The detent notches are also fixed relative to them. So slow speed adjustment consists of merely positioning the dial to the slow end of the groove, and rotating the base to align the pointer with '700'. The detents will more or less self position. After securing the base, the high speed stop can be 'adjusted. I believe it only serves as a way to make the stop coincide with the last detented position.

Also the cam follower has details that I missed earlier. The major non-symmetrical feature is a sloped shape that I missed earlier.

The edge is narrower on one side -

than the opposite side.

It needs to be positioned to the cam so that the slope helps the cam move the follower. EDIT: The skinny side provides provides the same clearance as the fat side since the cam diameter varies as it passes through the follower.

This is needed most when the cam is pushing against the follower.

Finally the spring washer works best where I found it(between the knob and the base).

EDIT: Notice the skinny side faces the larger diameter direction of the cam.

I was not satisfied with either the feel(not smooth but grating) nor the locking function. The front wedge was totally ineffective, and the tension needed to be maxed out for the rear wedge to clamp.

Two things were apparent. The 'spacer' and front wedge did not slide in the bore, but were jamming. There were some small burrs caused by dings and wear. The bore had a protrusion that I believe was caused by the screw that fastens the worm gear bracket bottoming out in the threaded hole. After gentle filing of those parts, they moved in the bore with no restrictions.

Even after cleaning that up, the original problems remained. I finally came to the conclusion that the grating was caused by the extreme tensioning. So after much examining, and much head scratching, I concluded that the spacer between the front wedge and the handle 'cam' was worn to the point of being too short. I slipped a retaining ring on the shaft between the spacer and the front wedge. This acted as a shim to effectively lengthen the spacer.

All is now 'better', but the 'shim' dimension is critical. Too thin and it is ineffective. Too thick and the front wedge will not release from the front way tube completely. I will try different amounts to achieve a reasonsable 'compromise'.

I did not take any pix of this 'activity'.

The shim was located between the spacer and wedge in the bottom right in this pix.

Last thing to finish the headstock is to attach the belt cover. A little bit different from slapping it on a M5/V/7.

The headstock positioning clutch release must be positioned against the movable plate. The large 'lubricating' hole is a help by allowing one to see it.

The headstock positioning clutch release must be positioned against the movable plate. The large 'lubricating' hole is a help by allowing one to see it.

Cover complete. I think a newer(longer) hub would look better on the idler shaft.

Headstock complete!!!!!!!!!! * Dreary day when taken. Better pix coming when attached to the upper assembly(next).
[ATTACH]26443[/ATTACH]

The paint got a bit 'distressed' over the belt 'journey'. I will likely just touch it up(or ignore it).

* Well the true MVII quill still needs to be broken down etc.

MVII motor belt length

This thread addresses the proper length of the motor belt for the Mark VII as well as later additional problems. At first confusion reigned. So it behooves me to say up front(here) that the correct length is 30.5".

To see more about the Mark VII belt length to go
http://www.shopsmith.com/ss_forum/maintenance-and-repair-f10/mvii-motor-belt-length-t13906.html