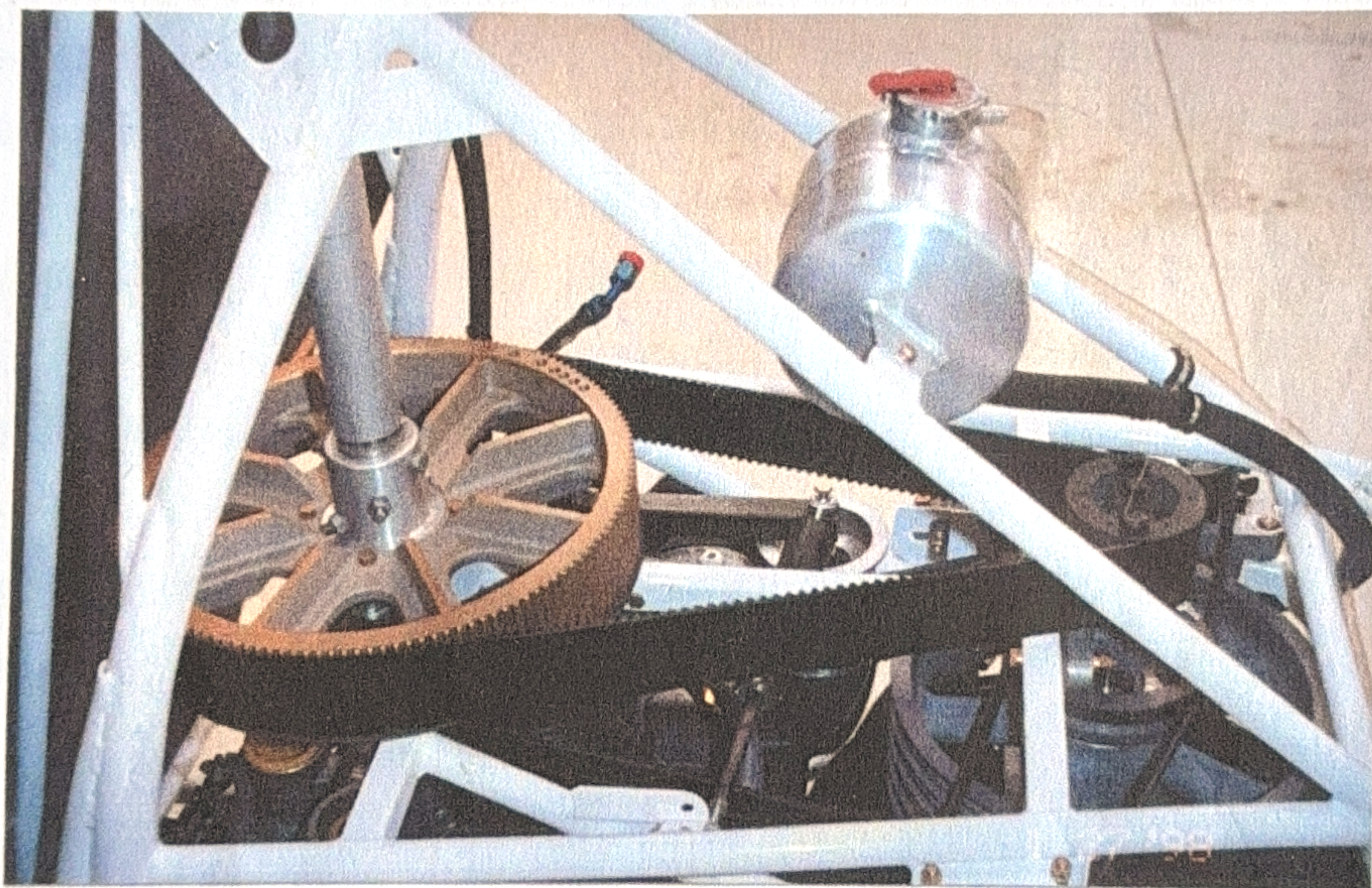


**INSTALLATION MANUAL**  
**FOR THE**  
***"PRO-DRIVE"***<sup>TM</sup>  
**MAIN ROTORSHAFT DRIVE CONVERSION KIT**  
**FOR**



***ROTORWAY* HELICOPTERS.**



# NOTICE

## To Owners of *ROTORWAY* "Scorpion" and "Exec" Series Helicopters Delivered Prior To 1990.

This manual was written to cover the current production series of *ROTORWAY* helicopter kits and contains procedures which are not necessary on models produced before 1990. As prior models were not equipped with a Sliderball Clamp, the procedures regarding the release of the Sliderball prior to lifting the Main Shaft are somewhat simplified. It is unnecessary on these earlier models to measure Sliderball clearance or to mark its location on the Main Shaft. It is only necessary to remove the Sliderball "through-bolt" in order to release the Sliderball and permit lifting of the Main Shaft

The procedures in the section entitled "MAIN SHAFT LIFTING - PREPARATION, DISCONNECTING THE CRITICAL STUFF" on Page 5, "Check Box" items 1 and 2 may be disregarded. On re-assembly, disregard "Check Box" item 15 on Page 20, but don't forget to reinstall a new Sliderball "through-bolt."

**ALL OTHER PROCEDURES MUST BE FOLLOWED TO PRESERVE THE INTEGRITY OF THE RIGGING OF THE AIRCRAFT!**

Upon re-assembly, it is strongly recommended that new, aircraft quality (AN) fasteners, bolts and nuts, etc., be installed at each location from which they were removed during the course of the conversion. Fly like a Pro--

**FLY A "PRO" available only from PRO-DRIVE, INC.**

Route 3, Box 12C  
Cleveland OK 74020

Telephone: (918) 243-7635

E-mail: flyapro@aol.com



## INTRODUCTION

In acquiring the **PRO-DRIVE** Rotorshaft Drive Conversion Kit for your **ROTORWAY** helicopter you have obtained the greatest improvement in rotorshaft drive technology since the introduction of the single-place "*Scorpion*."

In just a few short hours you will be able to experience the joy of quieter, smoother, more reliable rotary wing flight. First, however, take a few minutes to familiarize yourself with the conversion and how it works, and what will be required in the way of tools and equipment to install it. So we're all on the same page, as far as nomenclature is concerned, we'll refer to all of the **ROTORWAY** parts by the same names that they are assigned in the Construction Manuals and on the various construction drawings.

Now, identifying the parts provided by **PRO-DRIVE** may be a little more difficult. After all there are four of them, and three have teeth, but if you'll look at them very carefully you'll see that the two with the teeth on the outside aren't the same size, and the other one has it's teeth on the inside, the other part doesn't have teeth at all, but the hole through it is smaller than in the other three. Got that now?

When you look at these parts, you're probably going to think to yourself, or maybe even say out loud, "Jeese--I could'a gone down to the supply house and bought this stuff and saved a lot'a money!" Well, forget it--you couldn't have. While these parts may look like something that you can buy off-the-shelf--they're not. There are some very subtle differences between supply house parts and the ones

that you received from **PRO-DRIVE**. So different are they, in fact, that there is a patent pending on them.

The ultimate goal of every homebuilder should be to take as much "experimental" as possible out of his aircraft by using proven and tested materials, equipment and methods. We have done the experimentation, developed the equipment and proved the method so that you don't have to. So, if your friend, Leroy, wants to convert his drive using stock components--that's his business--and his neck.. But, we can tell him before he starts, "it ain't gonn'a work!"

We suggest that you take the time to first read, all the way through, the following instructions to familiarize yourself with the steps and procedures for accomplishing this conversion. The time spent in preparation will be well-spent and will be repaid several times over when you get into the actual "nuts and bolts" work. So read on, and prepare yourself for a new and exciting experience in quieter, smoother and safer rotary-wing flight with **PRO-DRIVE**.

## CAUTION !

**PRO-DRIVE, INC.** neither recommends, nor condones, the re-use of any aircraft fasteners, bolts, nuts, etc., or any part that may be subject to damage, however slight, through removal, replacement or handling!



## TOOL AND EQUIPMENT LIST

Before you start to tear into things it's a good idea to make sure that you have all the tools and equipment that you will need at hand. That should present no problem since, for the most part, you'll be using exactly the same tools that you used when you originally built the helicopter. Anyway, here's a list of the things you'll probably need, or really wish you had:

**ROTORWAY** Construction Manuals, Drawings

Chain or Cable Hoist, 1 Ton Capacity

Small Hydraulic Jack, 2 Ton Capacity

Web Strap, 1" x 6' or 1/2" Nylon Rope

Scrap Wood 2 x 4 - 10 inches long

Diagonal Cutting Pliers

Plastic Head Hammer

Ball Peen Hammer, 2 Pound

Punch, Line-Up, Tapered, 12"

Straight "Pin Drive" Punch, 1/4" x 6".

Screwdrivers, Phillips and Slot. Nutdrivers

Screwdrivers, "Stubby" W/ 3/8" blade, (2)

Wrenches:

Box or Open End, Set, Fractional/Inch

Including: 5/16", 3/8", 7/16", 1/2", 9/16"

Socket Set w/ratchet in above sizes

Allen (Hexagonal) Wrench Set

Torque Wrench, 3/8" drive

Small Tube of "Loctite" ®, Red

Thickness or "Feeler Gauge"

File, 8" or 10" Mill Bastard

Electric Drill, 1/4" (optional)

or Sheet Metal Snips (Dutchman)

Drill Press and Letter "D" drill bit

Gear Puller, 2 or 3 Jaw

"Scotch-Brite" ® Pad, Fine

Clean Cotton Rags

Solvent, WD-40, and a small can of 3 in 1 Oil

Straightedge, 36"

Dial Caliper, 6"

Micrometer, 0-1" (helpful) and, oh yeah,

Order two 170° Heat Dots from **ROTORWAY**.

In addition to the above, you're going to need a place to hang that chain-hoist or "come-along" that is high enough to allow you to raise the rotorshaft vertically about 9 inches. A rafter in the hanger or shop will do nicely, but lacking that, that big shade tree out back will serve equally as well. Although you're actually only going to be "raising" the weight of the rotor and it's shaft, it may be necessary to "load" the shaft with the weight of the helicopter to cause the shaft to slip out of the bearings, so it is recommended that you select a hoist location capable of supporting the entire weight of the helicopter. It is also strongly recommended that you hang the hoist before wheeling the helicopter under it. People have been known to drop little objects, like chain hoists, while hanging them over things to be lifted. A 25 pound hoist falling on your canopy, rotor head or anything else,



could ruin your whole day. So, hang the hoist first, and then you won't have to worry about it any more. It'll be up and out of the way. If the hand chain is in the way, hang it on, and wire it to, the load hook.

## OK, LET'S GET STARTED !

### DISMANTLING

We'll go through the steps in their order of accomplishment, so watch carefully now not to get anything out of order. We're going to start out by doing everything backwards, so if you get lost somewhere, remember that the **ROTORWAY** Construction Manual is **the authority**, and we're reading it backwards.

### COWLING REMOVAL

Carefully, unless you really want to repaint, remove the rear and front "doghouse" sections and put them in a safe place where Leroy can't back over them with his pick-up truck. Then remove the lower and upper rear panels, port and starboard, and put them somewhere else, so that even if Leroy does get the doghouse, he won't get these too. You're probably going to have a lot of cleaning to do on those rear panels, especially the lower ones, so you might want to put some solvent or soap on them and let it go to work. while you're removing other parts.

Then remove the bolts, nuts, and washers that secure the Coolant Surge Tank to the airframe, and snip the "Tyrap" that secures the coolant and overflow hoses to the airframe to allow the tank to be moved aft, out of the way. It should not be necessary to remove the hoses from the tank.

### CHAIN OIL BATH COVER REMOVAL

Now that you have access to the Rotorshaft and Drive Train the first thing to remove is the Rain Shield. Since you will not be re-installing this part you may either drill out the two 1/8" Aluminum rivets that hold the edges together, or simply cut it off with metal snips by making a diagonal cut from the outer edge about 75° from the lap to a point past the innermost rivet and the rotorshaft, then remove the Hose Clamp that retains the Rain Shield to the Rotorshaft. Back the screw all the way out of the clamp strap to open and remove the clamp.

Now, remove the four screws that secure the Top Front and Top Rear Oil Bath Covers together and remove the four Tension Springs that hold the Top Rear portion on the Lower Oil Bath Pan. It may be necessary to insert a putty knife or some similar tool into the seam between the two top covers to separate them. Then, slide the Rear Top Cover aft to remove it. The Top Front Cover will need to be lifted slightly and



rotated around the Main Rotor Shaft about 100° to allow it to be removed. *Done*

With the covers out of the way you can remove the oil from the pan. This may be done by either of two methods--muck it out with rags, or drain it out into a suitable vessel. The first method is self-explanatory and messy. The second is perhaps a little slower, but a whole lot neater. Since you're not going to use the oil bath again, we suggest the second method, which is, really simple. Just place a suitable open-top container under the oil bath and drill a hole through the bottom of the oil bath directly over the container, from the top down, and let the oil drain out taking care to not let (any more) oil get on the main, accessory, and tail rotor drive belts.

### BELT INSPECTION

Slack-off the tension on the tail-rotor drive belt and on all other accessory drive belts, as it will be necessary to re-adjust their tension after the installation of the conversion. Actually, since you have the cowling off and you're going to be removing the sprocket from the secondary drive shaft, this would be an ideal time to thoroughly inspect all the drive belts for wear and/or damage and make any replacements that may be necessary now or in the near future. Remember that if the primary tail rotor drive belt shows signs of oil contamination, there is a very

strong probability that the secondary tail rotor belt will also have been contaminated. That primary belt is not only a drive belt--it's also an excellent conveyer belt. So, unless you just derive a particular enjoyment from removing and re-installing cowling, you just might want to check all the belts now. If you replace any belts be certain (make that *damned certain*) that you go back together according to **ROTORWAY's** instructions, and don't forget that **any new belts must be "run-in" and re-adjusted "by the book."**

### CHAIN REMOVAL

Wipe any remaining oil out of the pan and off the sprockets and chain and remove the Master Link Insertion Plate. Rotate the sprockets until the Master Link is directly over the Master Link Insertion port, then place a piece of cardboard, heavy paper or a rag under the insertion port and across the primary drive belts to prevent any of the link plates from falling into the radiator. Remove the master link clip from the top of the chain, slip the master link downward out of the chain and remove it through the insertion port. Account for all the parts. There should be seven, one master link clip, five link plates, and one master link. When they're all accounted for, remove the cardboard or rag and remove the chain from the sprockets and up and



out of there. Put the chain in Leroy's pick-up to haul to the scrap yard. ✓

## SECONDARY DRIVE SPROCKET

### REMOVAL *done*

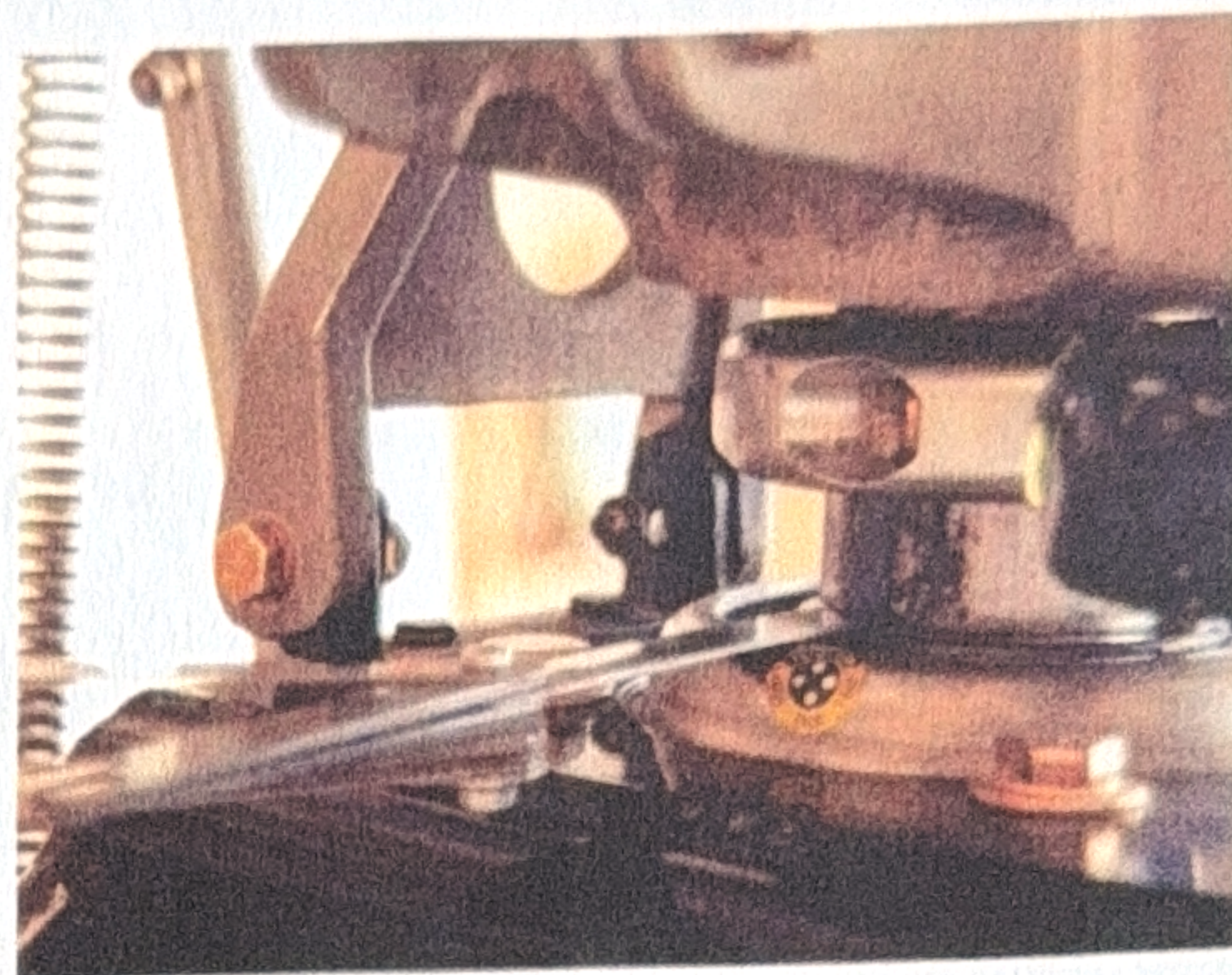
Cut and remove the safety wire securing the heads of the three Retainer Plate bolts to the top of the driving sprocket and the secondary drive shaft, remove the bolts, then using an appropriate gear puller, lift the sprocket clear of the shaft and take it out to Leroy's pick-up. If the shaft key came out when you removed the sprocket, fine. If not, remove it from the shaft keyway, taking care not to damage the shaft.

## MAIN SHAFT LIFTING - PREPARATION, DISCONNECTING THE CRITICAL STUFF.

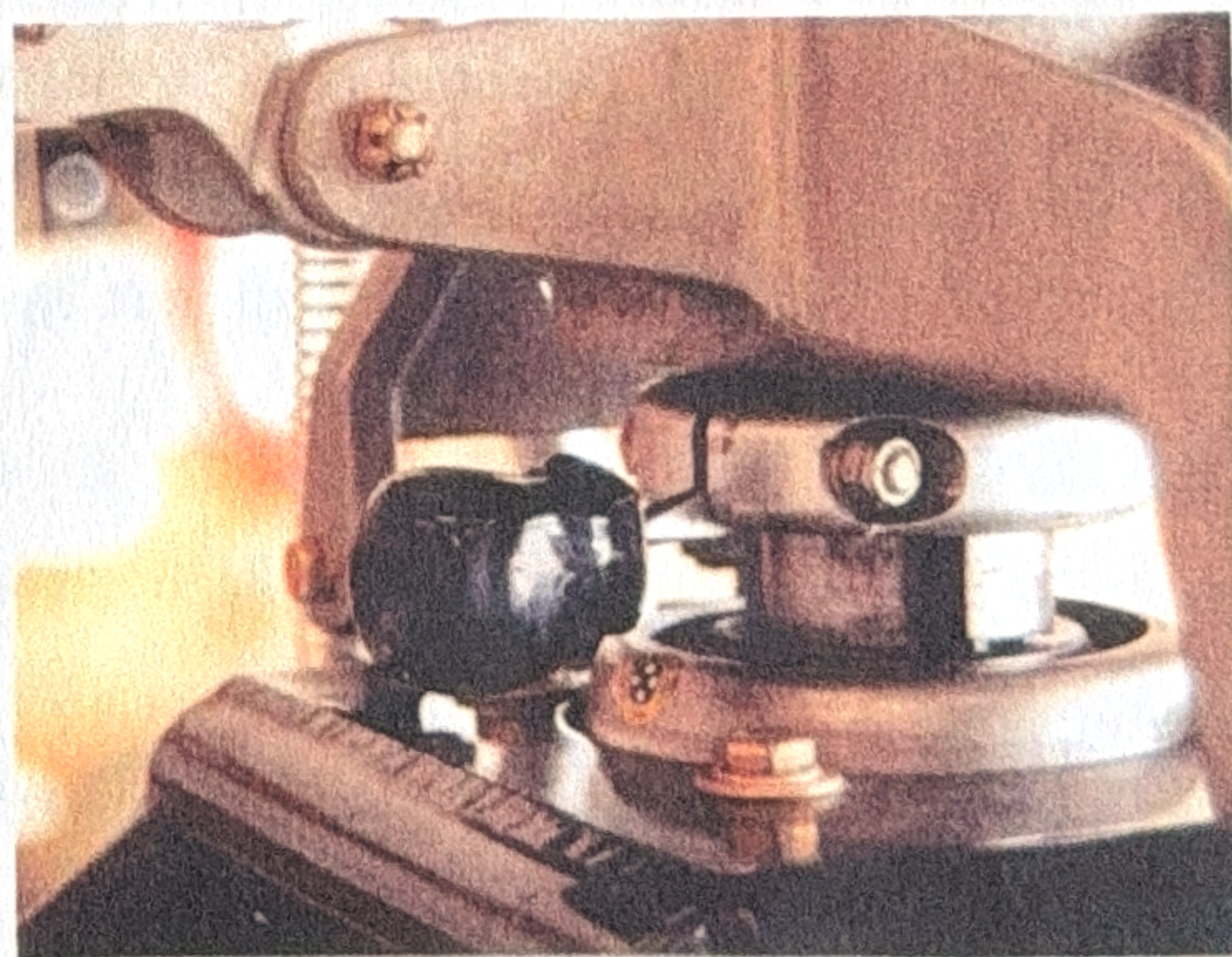
Okay, up to now what you've done is mostly "nut and bolt" stuff that even Leroy could have done, but what you're about to do **can affect the rigging of your aircraft, so pay close attention to each detail so that when you finish the conversion you won't have any re-rigging to do.** We've provided check boxes (☐) for each of these operations, and suggest that you use them.

1. ☒ With a feeler gauge, verify the clearance between the bottom of the Sliderball and the top of the Main Rotor Thrust Bearing, with the

collective in the full down position. (It should be approximately .050") Enter Clearance



2. ☒ Remove the bolt and nut from the Sliderball Adjustment Collar and insert the tip of a "stubby" screwdriver into the slot in the collar and drive it in just enough to spread the slot to loosen the collar on the Sliderball. ✓



3. ☒ Snip and remove the Plastic Wire Tie (Ty-  
rap) from the top of the Dust Boot. ✓



4. ☐ Mark the Master Pitch Link (M) and it's upper end (▲). Also mark the Master Pitch Horn Clevis (M). Remove the bolts, nuts and washers attaching the link to the Pitch Horn Clevis and the Rotating Swashplate and remove and save the Master Pitch Link. ✓

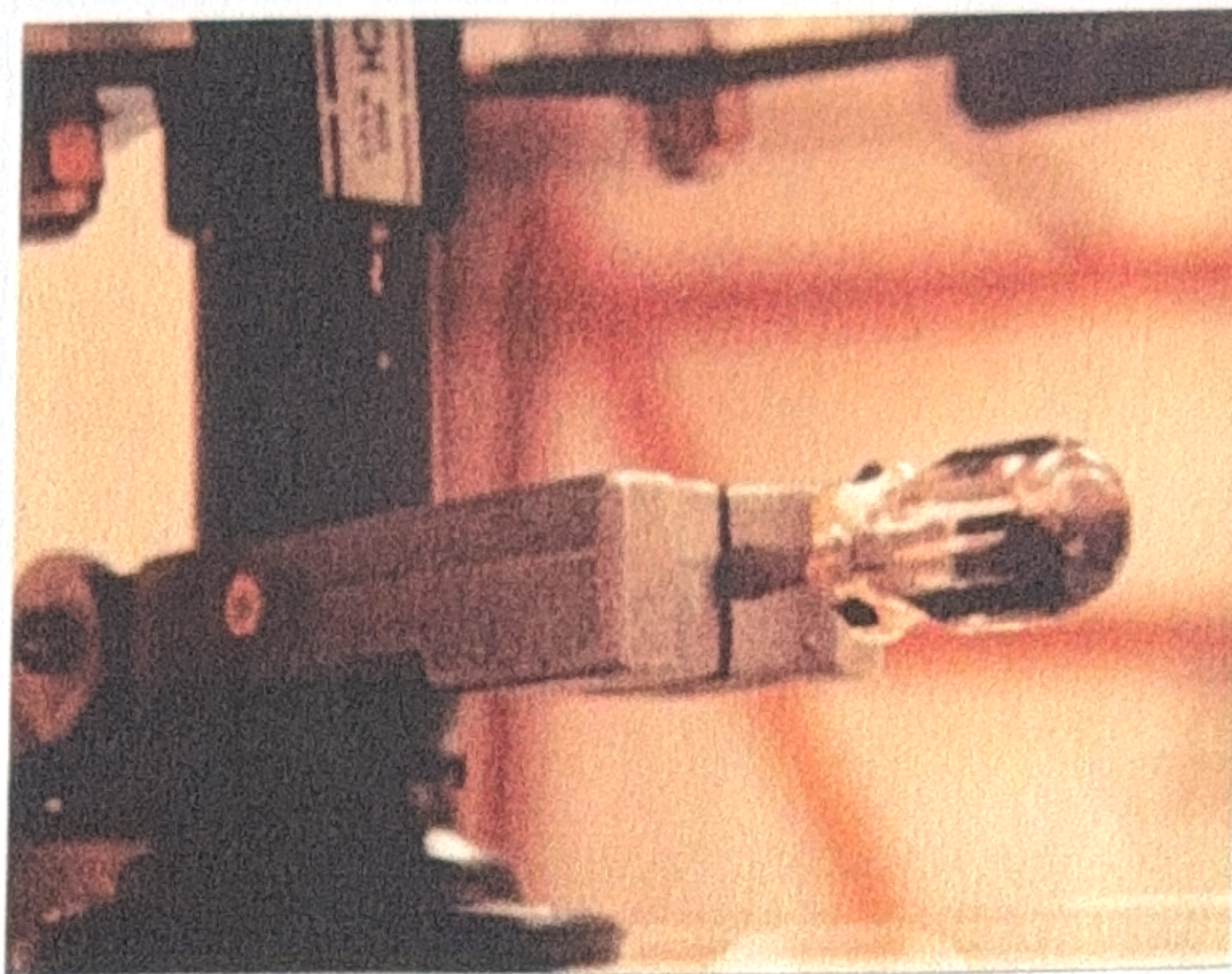
5. ☐ Mark the Slave Pitch Link, as such (S), and also mark it's upper end (▲). Also mark the Slave Pitch Horn Clevis (S). Remove and save the Slave Pitch Link. ✓

6. ☐ With a **sharp** marker pen, make corresponding vertical index marks on the Counterbalance and on the Main Rotor Shaft. Also make a horizontal mark on the Shaft at the point where it exits the Counterbalance. **Be precise, the Counterbalance must be returned to this exact position upon re-assembly**, or the integrity of the rigging will be compromised! ✓

7. ☐ Remove the Counterbalance Clamping bolt and nut and insert a "stubby" screwdriver into the end of the slot, and drive it in, just enough to spread the slot to loosen the Counterbalance on the Shaft. ✓

**Keep in mind that the Pitch Links, the Counterbalance and the Sliderball Adjustment Collar must be re-installed in exactly**

**their same locations and orientations to preserve the current rigging of the aircraft!**



8. ☐ Now, moving down the Main Shaft (Rotorshaft), using that indelible felt marker pen, make an horizontal index mark across the vertical abutment (where the two halves of the Safety Spacer meet), so that it may be re-installed in the same relative position, then carefully remove, and save, the Rotor Tach Magnet clamp, then remove the Hose Clamps securing the two halves of the Safety Spacer to the shaft, then remove, clean and save, the two Spacer halves.

9. ☐ Clean the rust-preventive grease from the Main Shaft then, again using the marker pen, make an index mark on the top of the sprocket hub and a corresponding mark on the Main Shaft. These marks will make it easier to re-install the hub to the shaft in the same position. It's a good idea to make another mark, way up high on the



Main Shaft, in linear alignment with the one you just made. **"Don't sweat the small stuff!"** What we're doing here is identifying the side of the shaft that matches the way the holes were drilled through it and the Hub in order that the bolts will go back easily, so a few degrees difference in the radial location of **these two** marks on the Hub and the Shaft won't make any difference.

10. ☐ Cut and remove all the safety wires from both ends of the three bolts that secure the sprocket to the Main Shaft (Rotorshaft), and remove the nuts. Using the plastic hammer, tap the bolts through their bores until the end of the bolts are flush with the Hub. If the bolts cannot be pulled out the rest of the way by hand, use a slender "pin drive" punch and continue to tap the bolts out of their respective bores. In so doing, be certain to keep the punch in alignment with the bores and use caution not to damage or deform them. When all three bolts (and the punch) have been removed, the Hub will be resting on the Lower Main Shaft Bearing and **any spacers** that were installed for alignment purposes. **[Note: it will be necessary to re-install any spacers that may have been used for alignment in their original positions to preserve the integrity of the alignment and rigging of the helicopter.]**

11. ☐ Now, working under the Oil Bath Pan, loosen the Allen Screw that secures the Lock Ring on the Lower Main Shaft Bearing and, using the long drive punch and a hammer, rotate the Lock Ring (opposite the direction of rotation) to release it from the shaft. **Save the Lock Ring.** Closely inspect the area where the lock ring gripped the shaft, and using a file carefully remove any burrs and polish the shaft with a "Scotch-Brite"® pad so the shaft will pass through the bearing without interference.

12. ☐ Now go up to the Main Rotor Thrust Bearing, and following the same procedure, loosen the Lock Ring and slide it down the shaft and carefully remove any burrs and polish the shaft in the area of, and below, the Lock Ring. **Failure to de-burr and polish the shaft at these locations will result in extreme difficulty in raising the shaft and may result in the seizure of the shaft in the bearing if any burrs enter the bearing bore.**

13. ☐ If you haven't already done so, you should now position the helicopter under the hoist in preparation for lifting the Main Shaft. If you weren't listening earlier, and haven't yet hung the hoist, **move the helicopter well out of the way before doing so!** **Note:** This is operation No. 13 ! So don't try your luck. ! ✓



14. □ As the Main Shaft (Rotorshaft) is inclined slightly forward, from the vertical, it will be necessary to "block-up" under the skids, directly under the forward Landing Gear with  $2 \times 4$ 's, or preferably high-density Styrofoam blocks, to bring the Rotorshaft into as nearly a vertical position as is (practically) possible. This is an "eyeball," not a "hair-splitting" operation, so using the free-hanging load hook of the chain hoist as a plumb bob to the center of the top of the (apparently vertical) Rotorshaft is close enough. ✓

### RIGGING FOR MAIN SHAFT LIFT

Rig a lifting sling by passing the ends of a web strap or rope around the Rotorshaft under the Main Rotor Drive Pin and between the Rotorshaft and the Teeter Blocks and tying the ends together with your very best Boy Scout, non-slip knot. That will give you two half-loops to place in the load hook. Raise the load hook just enough to take out the slack, but not enough to exert any lift on the Main Shaft (Rotorshaft).

Now, get that piece of cardboard again, and with scissors, or your metal snips, fabricate a "catch pan" which will fit across the top of the Engine Pulley and the Air Cleaner, under the Lower Main Shaft Bearing. Turn the edges up an inch or so and staple or tape them in that position to make a little open-top box. This may seem like

an unnecessary bit of work, but do you remember whether you put any spacers between the Lower Bearing and the Sprocket Hub, or how thick they were? **So don't argue--make the box, catch them, and you won't have to tax your superb memory.**

### LIFTING THE MAIN SHAFT

Before beginning to lift, go back and check all the steps to be certain that everything that should be loose, is loose, and that everything that should be removed, has been removed, and that the Main Shaft has been de-burred and polished.

With the helicopter positioned under the hoist, the Main Shaft oriented vertically, and the lifting sling in place, begin to raise the load hook to place a lifting force upon the Main Shaft, while observing the shaft to see if it is rising. Continue to increase the lifting force until one of the following two events occurs:

- 1) the shaft begins to move upward or;
- 2) the entire helicopter begins to rise.

1) In the event the shaft begins to rise, it is slipping through the upper Main Shaft Bearing and out of the Lower Main Shaft Bearing, and that's exactly what you want to happen. So, continue to **raise the shaft for about 8 to 10 inches -- then stop!**