RIGGING: SWASH PLATE

The swash plate is a disc that when tipped at an angle to the main shaft (by cyclic control), makes the main rotor blade tip to the same angle. The swash plate tips the main rotor blade in different attitudes to maintain balance of the helicopter in flight. When rigging the swash plate, do the following:

1. All angles of the swash plate are set in reference to the main rotor shaft.

   NOTE: Use shims under the skids until the main rotor shaft is 90 degrees to the ground both fore/aft and laterally.

2. When the cyclic handle is against the forward stop, the swash plate must tip 5 degrees down in the front, in reference to the main rotor shaft.

3. When the cyclic handle is against the rear stop, the swash plate must tip 5 degrees down in the rear, in reference to the main rotor shaft.

4. When the cyclic handle is against the left stop, the swash plate must tip 5 degrees down on the left, in reference to the main rotor shaft.

5. When the cyclic handle is against the right stop, the swash plate must be 5 degrees down on the right, in reference to the main rotor shaft.

6. Adjust the bias of the cyclic controls as described in this section.

Photo #28

The cyclic control cables are shown installed in the cable mount casting.

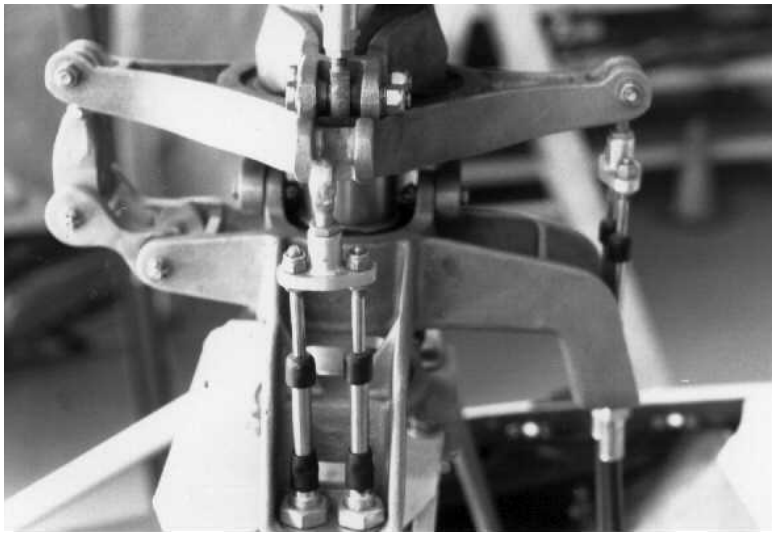

Photo #29

The cyclic control cables have been adjusted to the control "T". Notice the rod end is to one side of the opening.

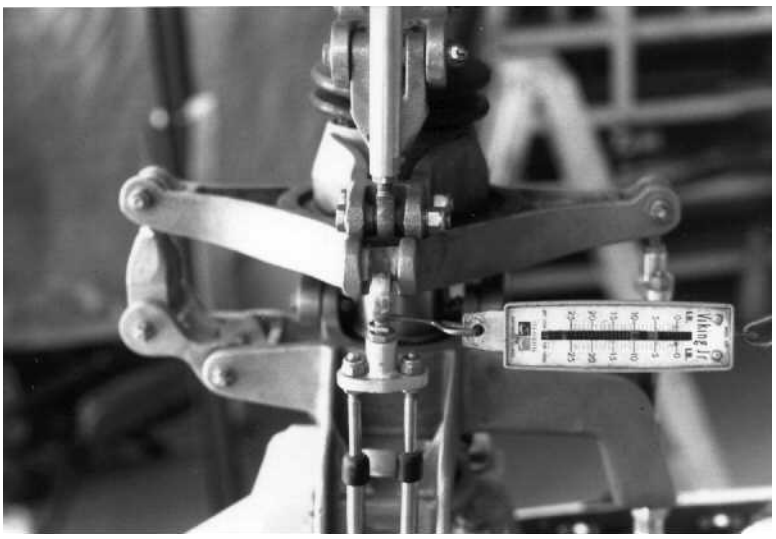

Photo #30

Using a spring scale, pull 4 lbs. to align the rod end with the slot of the swash plate to give the correct bias in the control cables.

Photo #31

When the correct bias is achieved on the cyclic control cable, install the rod end in the swash plate opening.

Photo #32

When setting the swash plate angles, the main shaft must be 90 degrees to the ground. Put two 5/16" bolts in the holes and place a straight edge on them. Set the protractor level 5 degrees and set it on the straight edge. Center the cyclic fore/aft and against the left stop.

Photo #33

Adjust the rod end indicated by the arrow until the bubble centers.

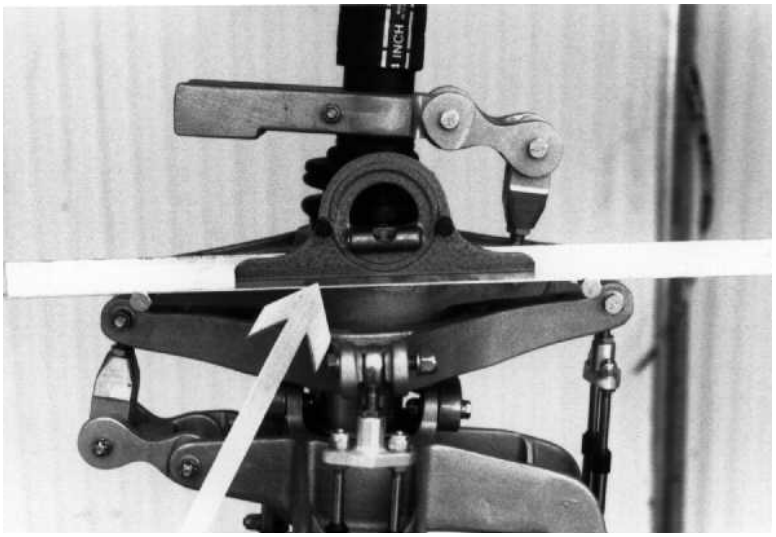

Photo #34

Set the protractor to 5 degrees in the other direction and place it on the straight edge. The cyclic control should be centered fore/aft and against the right side. The bubble should center; if it does not, the ratio of the cyclic and swash plate is off. Check the moment arm of the casting at each end of the cables. (The moment arm is the distance between the pivot point and the attachment point.)

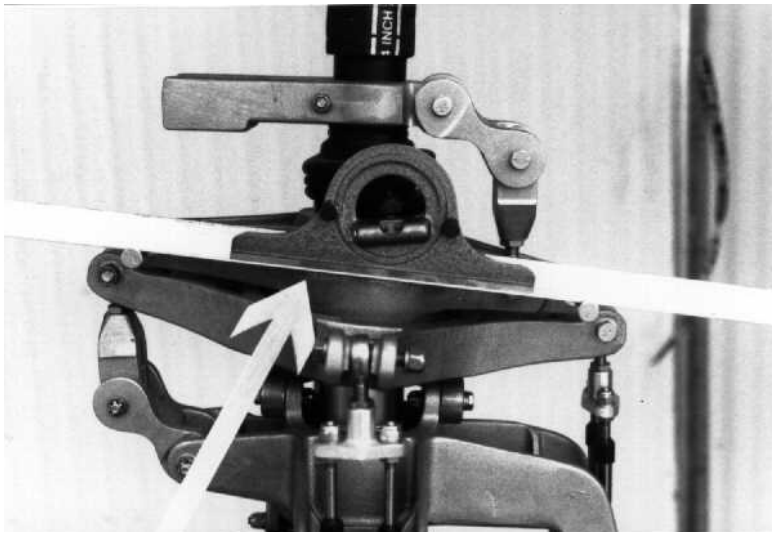

Photo #35

Remove the long bolts and rotate the swash plate to check the fore/aft angles. Install the long bolts and straight edge. Set the protractor to 5 degrees and place it on the straight edge. The cyclic should be centered laterally and against the forward stop to set the angle.

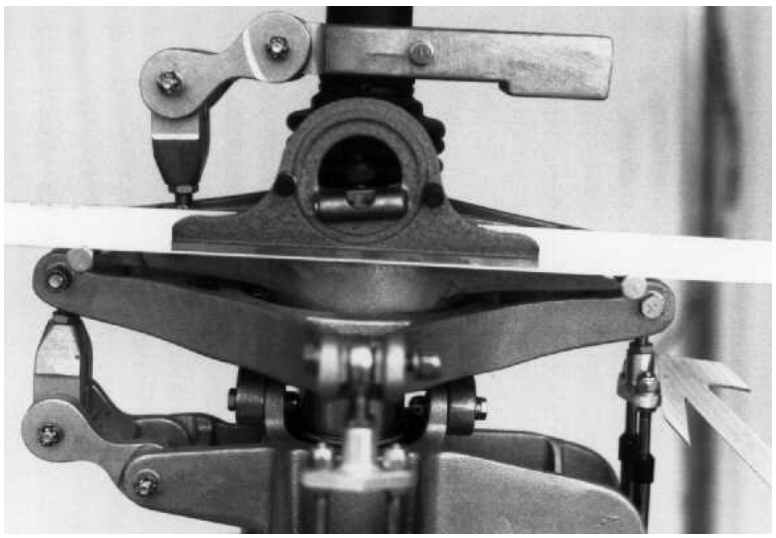

Photo #36

Adjust the rod until the bubble is centered.

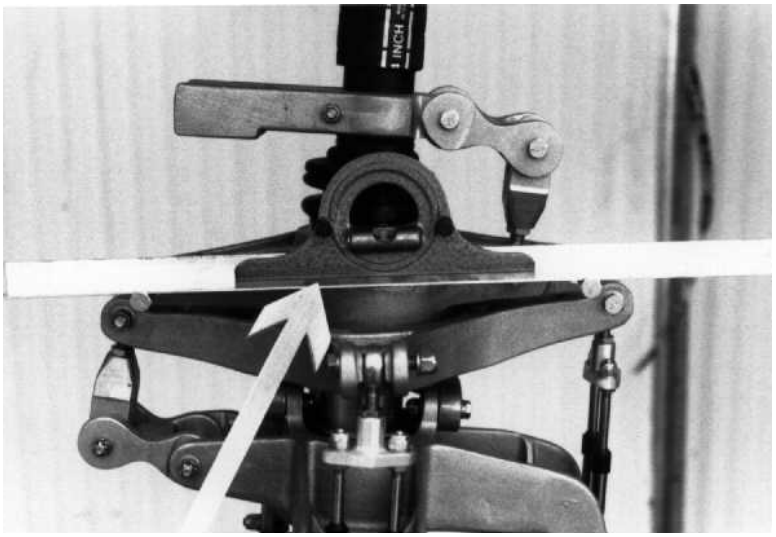

Photo #37

Set the protractor to 5 degrees in the other direction and place it on the straight edge. The cyclic should be centered laterally and against the rear stop. The bubble should center. If it does not, the ratio of the cyclic and swash plate is off. Check the moment arm at each end of the control cables.

RIGGING: MAIN DRIVE BELTS

The main drive belts turn all the rotating parts in the helicopter. If the belts are dirty or loose, they will slip and the parts will not turn at the correct speed. When this happens, the helicopter will not fly. To get the desired results from the main drive belts do the following:

1. The belts and pulleys should be clean. Use acetone and a clean rag (the rag should be damp but not dripping with acetone).

2. Be sure the pulleys are properly aligned.

3. Be sure the belts are at the proper tension.
   CAUTION: Do not over tighten the belts. Achieve the correct tension and adjust as necessary to maintain the correct tension.

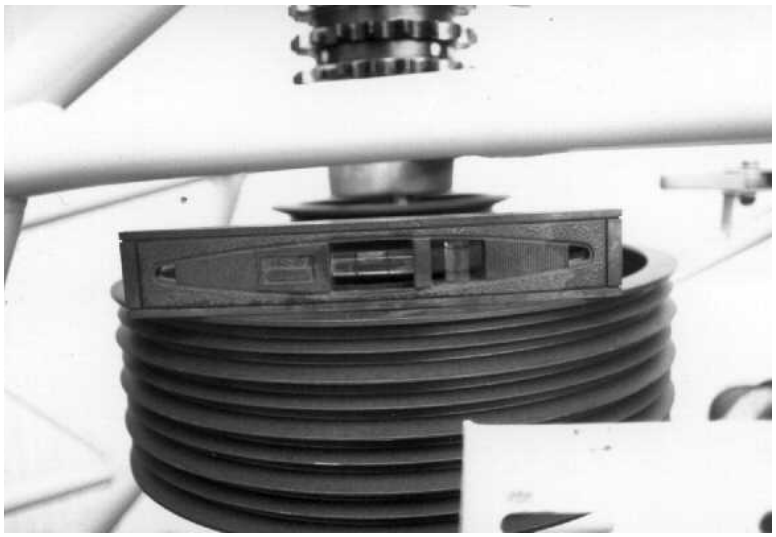

Photo #38

Level the secondary pulley by shimming under the skids.

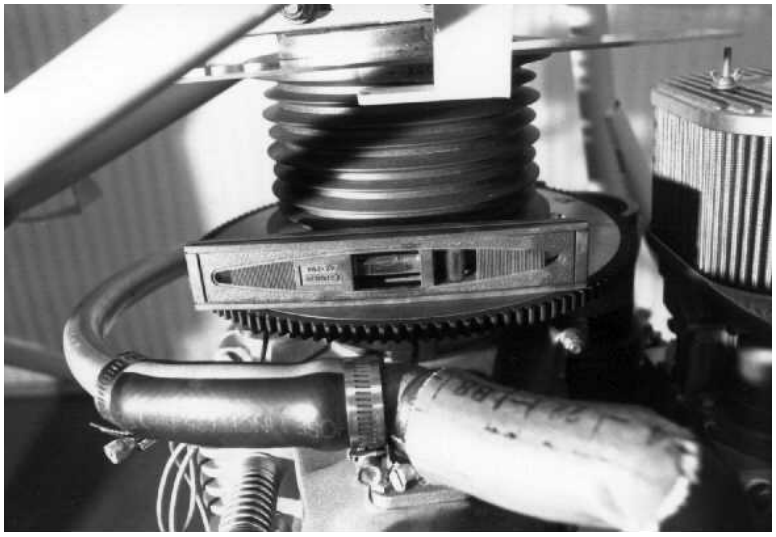

Photo #39

Level the engine flywheel by moving the top and/or bottom of the engine.

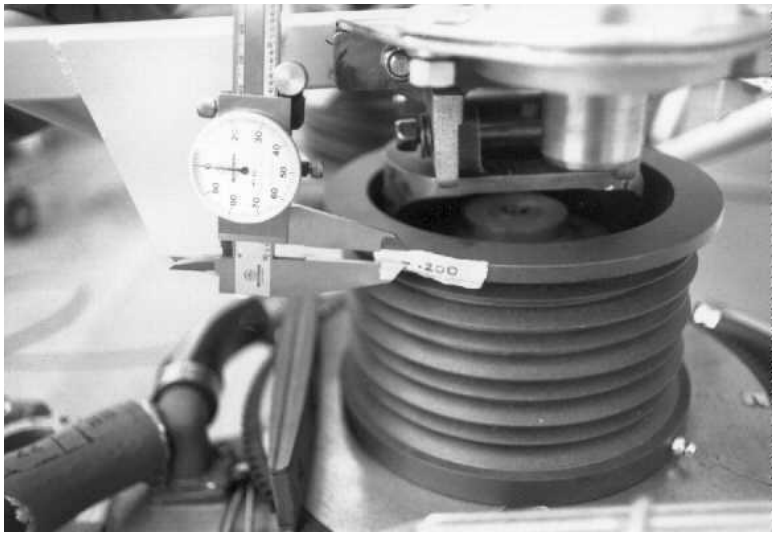

Photo #40

Mark the side of the engine pulley .200" from the top on both sides of the aircraft. This is necessary because the top of the pulley has approximately .200" more material above the belt grooves than the secondary pulley.

Photo #41

Place a straight edge on top of the secondary and idler pulley. The straight edge should be even with the mark on the engine pulley. The pilot's side is the tension side of the pulley, so if you have to choose one side to be perfect, use the pilot's side.

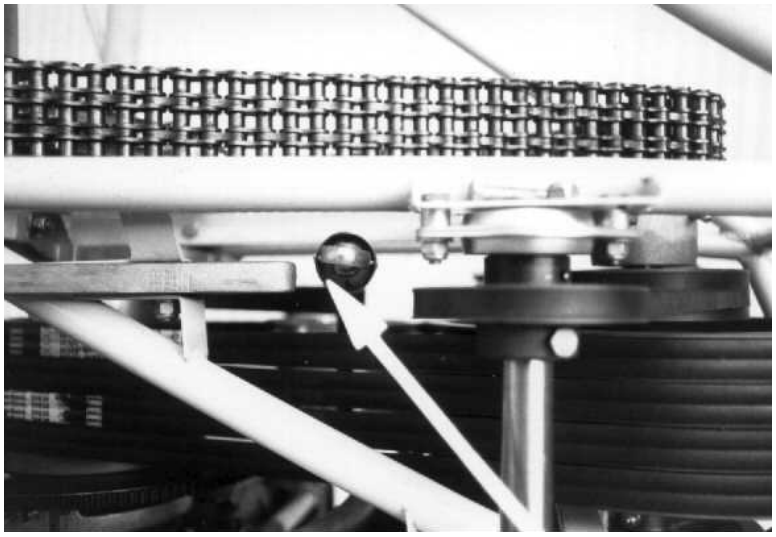

Photo #42

Remove the bolt that holds the rod end to the clutch arm casting.
NOTE: It is important to maintain clearance between the clutch tube and the square drive tube.

Photo #43

Move the idler pulley away from the belts.

Photo #44

The belts are tensioned by moving the engine forward. Apply 7 lbs. of pressure to one drive belt on the pilot side, it should move 1/2". The idler should not be touching the belts when making this test. When the clutch is engaged, the piston in the spring tube should move 1". Be sure the pivot arm bolt and the piston and the springs in the spring tube have been greased.

RIGGING: TAIL ROTOR DRIVE
E18-2000

The purpose of the tail rotor drive is to keep the tail rotor turning at the correct RPM. If the tail rotor drive is not installed and adjusted correctly, the pilot cannot correct for torque and maintain control of the helicopter. When rigging the tail rotor drive do the following:

1. Check to insure that the idler pulley mounting scissors at bulkheads #2 and #3 can pivot freely.

2. Clean the belts with acetone and a cloth. The cloth should be damp, NOT dripping with acetone.

3. The tail rotor drive belt tension should be checked at the front of the #1 bulkhead. Pull the belt 10 lbs. with a spring scale. The belt should move 1". When tightening the tail rotor belts, loosen the rear 1/4" bolts on the tail rotor shaft bearings and tighten the 5/16" nuts on the all thread rods. Re-tighten the 1/4" bolts when the belts are at the correct tension.

NOTE: BELT TENSION SHOULD BE MONITORED FREQUENTLY IN THE FIRST FEW HOURS OF OPERATION, UNTIL BELT STRETCHING HAS STOPPED. IT IS VERY IMPORTANT TO PREVENT THE BELTS FROM BECOMING TOO LOOSE, WHICH COULD CAUSE EXCESS OSCILLATION AND THE POSSIBILITY OF THE BELTS ROLLING OVER THE EDGES OF THE PULLEYS. A BELT THAT HAS ROLLED MAY BE DAMAGED INTERNALLY AND MUST BE REPLACED IMMEDIATELY TO PREVENT BELT FAILURE.

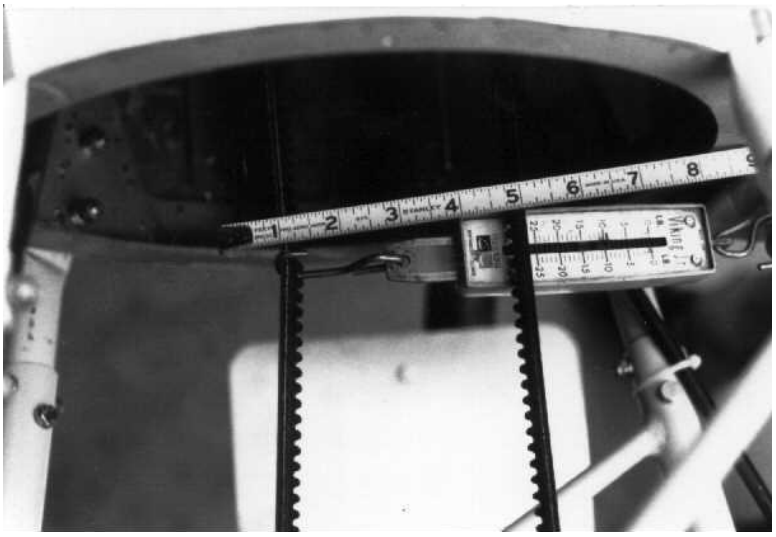

Photo #45

Use a spring scale and ruler to check the tension on the tail rotor drive belts at the front of the #1 bulkhead.

RIGGING: MAIN ROTOR BLADES
E20-2000

The main rotor blades are the wings which lift the helicopter and pull it in the direction that you are flying. When the two blades are made the same and are adjusted so they lift the same amount, the helicopter is a smooth flying machine. Rig the rotor system as follows:

1. The rotor hub plate must be shimmed correctly on the main shaft. Center of the outboard pitch pins and the center of the main shaft must be in a straight line to within .001". (Total Indicator Reading of .002".)

2. The main rotor shaft should be 90 degrees to the ground in all directions.

3. Center of the 9/16" retention bolt should be within 1.985" to 1.990" from the leading edge of the rotor blades.

4. Thrust blocks should be installed correctly on the rotor hub.

5. Both rotor blade chord lines should be level, with the control rod disconnected.

6. Both rotor blades should be the same weight.

7. Both pitch horns should be mounted to the retention strap the same.

8. Set the pitch on the rotor blades using the control rods, with the swash plate 90 degrees to the main shaft. With the collective full down, both blades are set at 1-1/2 degrees negative pitch.

9. Check the pitch on the main rotor blades when the collective is in the full up position. The positive pitch should be 9-1/2 degrees positive.

10. The teeter travel must be between 14 and 15 degrees total movement.

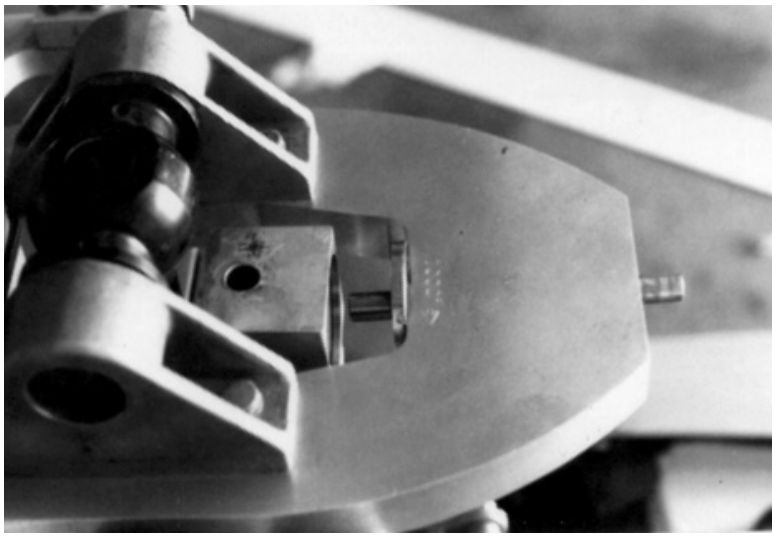

Photo #46

To mount and adjust the main rotor blades, do the following: clean the pitch pins (inboard and outboard) and apply a thin coat of grease. Install the thrust blocks with the master block on the end of the hub with the serial number.

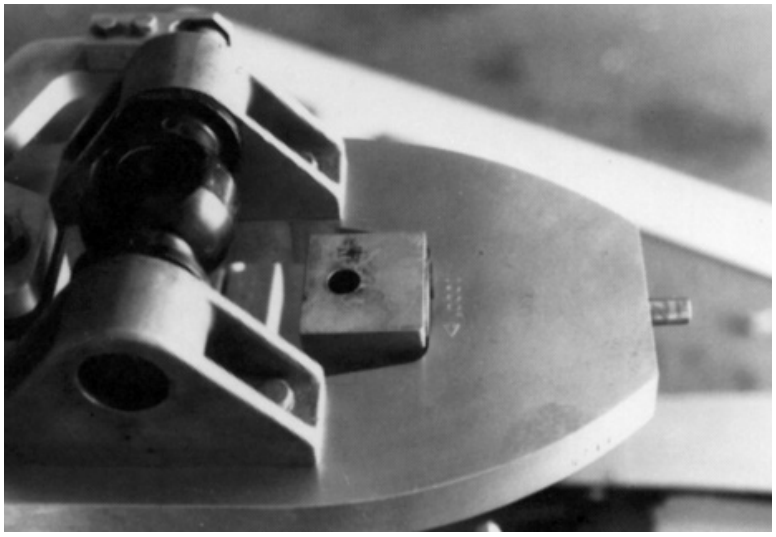

Photo #47

Check fit to inside of hub.

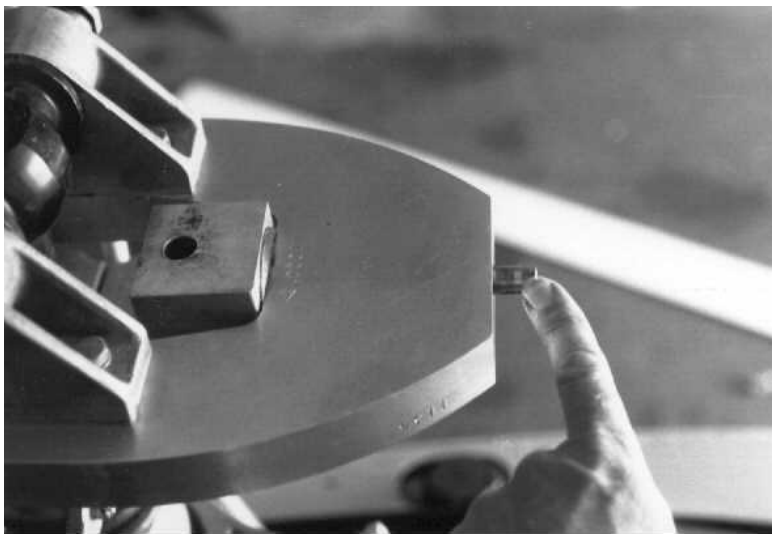

Photo #48

Line up the aligner block bearing (on the blade) with the outboard pitch pin, and slide the blade in place to install the 9/16" retention bolts. The blades must be held in the pre-coned position and not allowed to droop until both 9/16" bolts are tightened.
Note: After the first blade is in place, rest it on a ladder while the second blade is being installed.

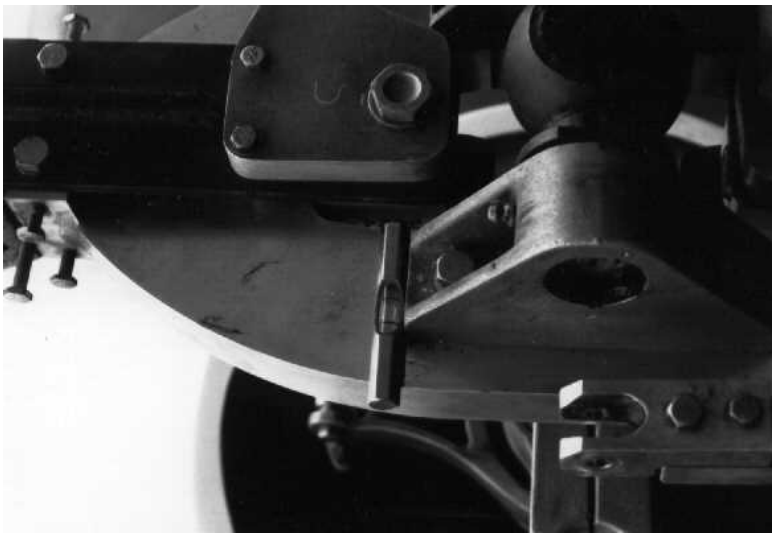

Photo #49

The rotor hub should be level laterally. If necessary, shim under the skids to level the hub. When the rotor blades are hanging unsupported on the hub, the blade must feather freely. If the blades do not feather freely, it will be impossible to do a static lead/lag adjustment.

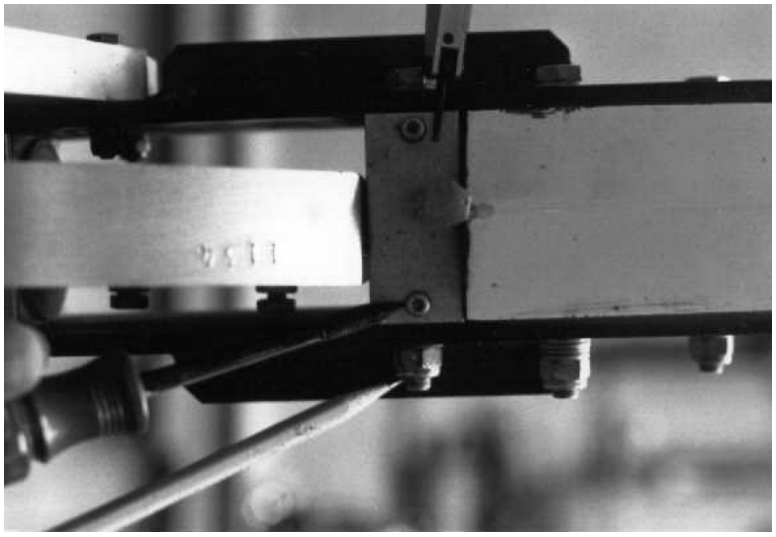

Photo #50

Loosen the 5/16" aligner block bolts and the allen screws. Use the all thread 1/4" bolt to level both blades. The blade sweeps on the 9/16" retention bolt and pivots on the inboard and outboard pitch pins. When the blade is aligned with the pitch pins, it will level itself if it is free to pivot on the pitch pins.

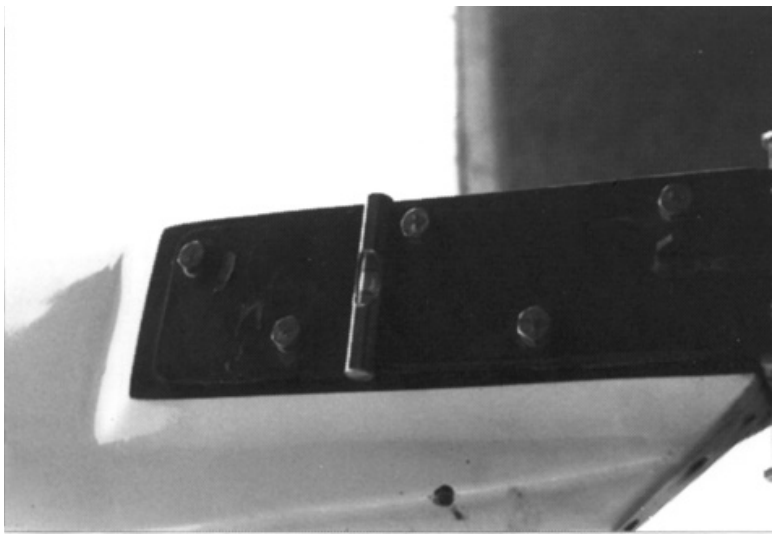

Photo #51

The slave blade is level when the blade is aligned with the pitch pins.

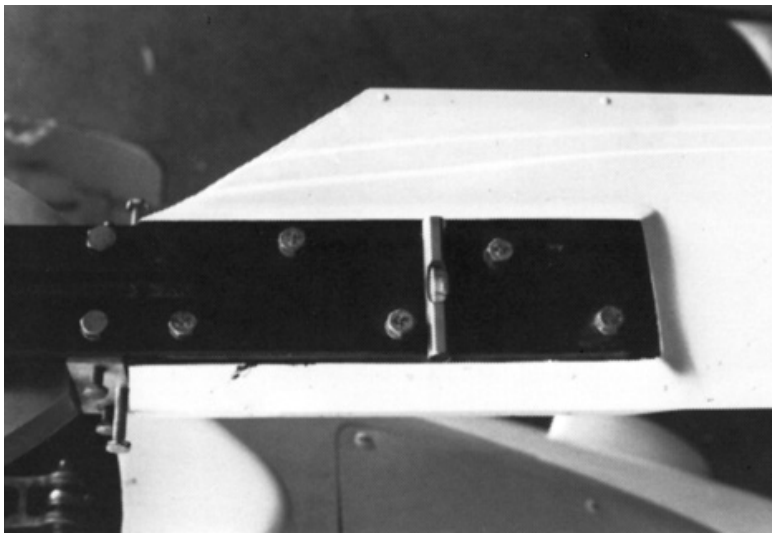

Photo #52

The master blade is level when the blade is aligned with the pitch pins.

Photo #53

The hub plate, master blade and slave blade should be level when all the bolts are tight and the static lead/lag balance is done correctly.

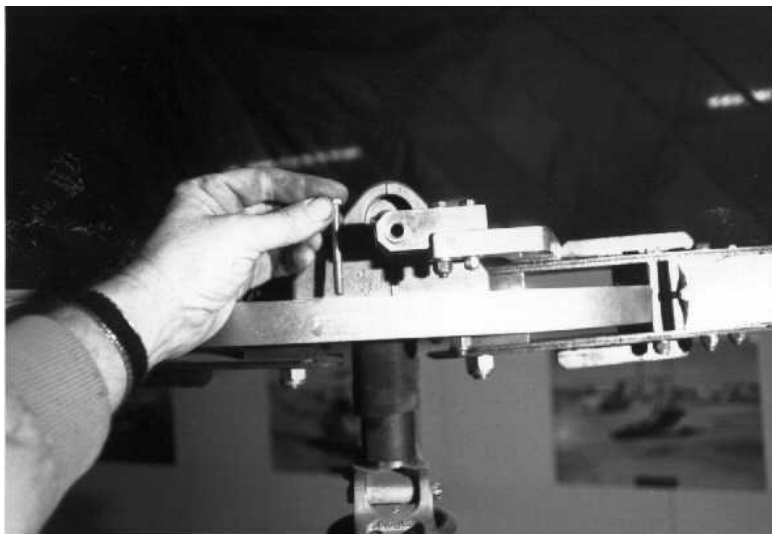

Photo #54

To check to see if both main rotor blades are the same weight, replace the 3/8" bolts in the teeter block with 1/4" bolts one at a time and remove the snap ring on the main drive pin to allow the hub to teeter freely.

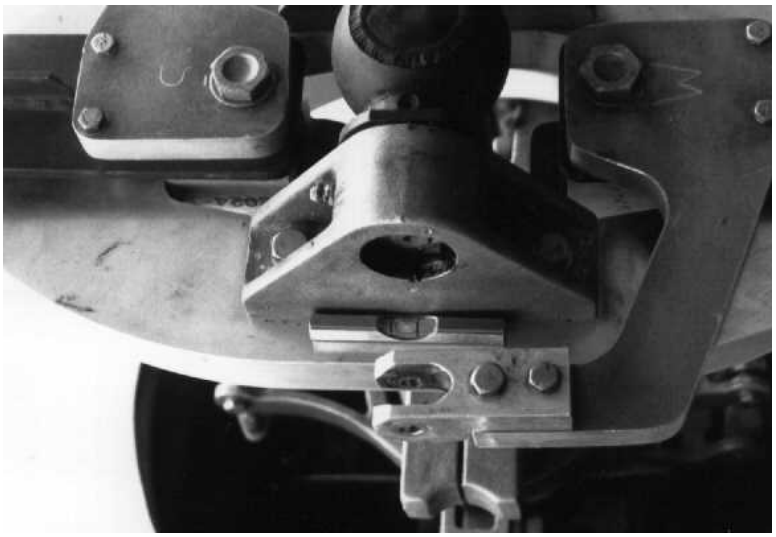

Photo #55

Place the level on the hub plate under the main drive pin so the weight of the level will not affect the balance of the blades.

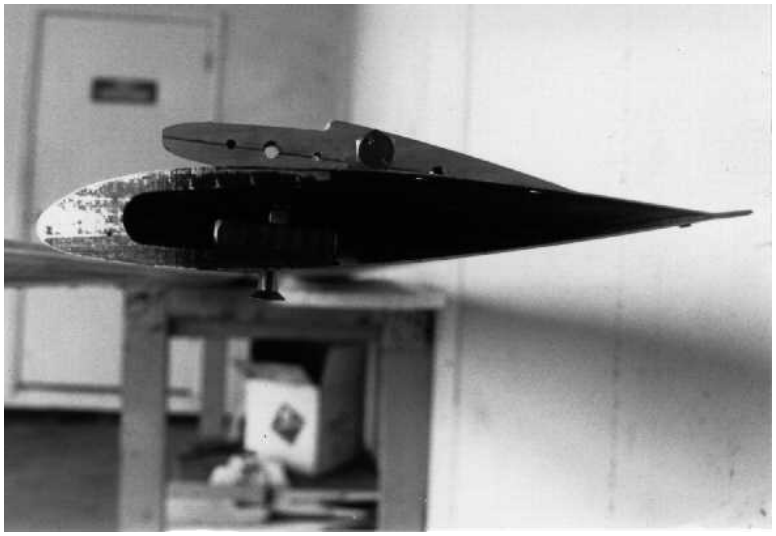

Photo #56

Remove weight from the tip weight in the heavier blade until the bubble on the level centers. Be sure the wood end caps and their screws are on the ends of the blades when balancing. Teeter the blades a few times and see if they balance each time. This will ensure a good balance.

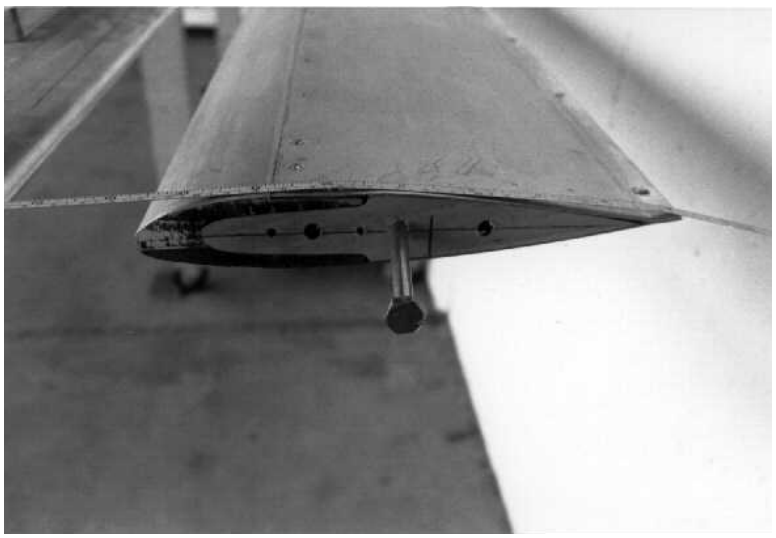

Photo #57

Install the tip plugs in the end of the blade and check the balance. When the balance is correct, remove the 1/4" bolts and re-install the 3/8"bolts in the teeter blocks one at a time. Put the snap rings on the main drive pin.
Note: Use a long 1/4" bolt in the vent hole of the tip plug for easier installation.

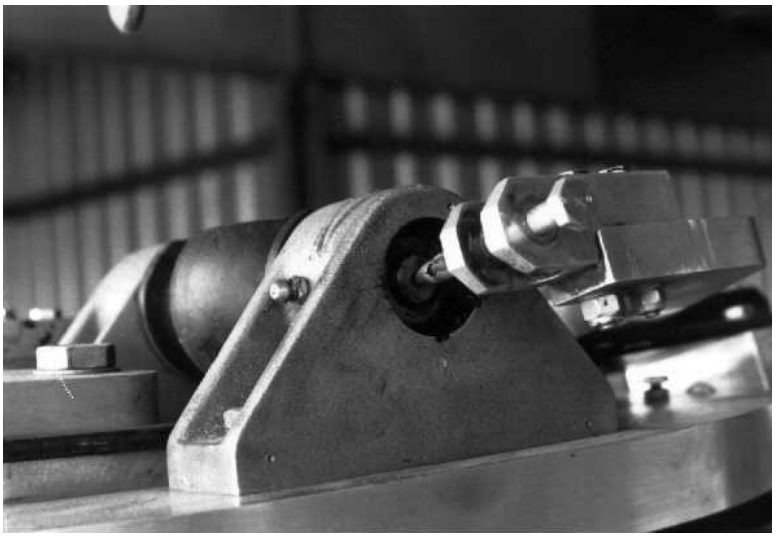

Photo #58

To locate the position for the pitch horns do the following: Grind the end of a long 5/16" bolt to a point and install it in the pitch horn clevis. Raise the pitch horn until you can align the point of the bolt with the center of the drive pin. Rotate the pitch horn if necessary to achieve this alignment.

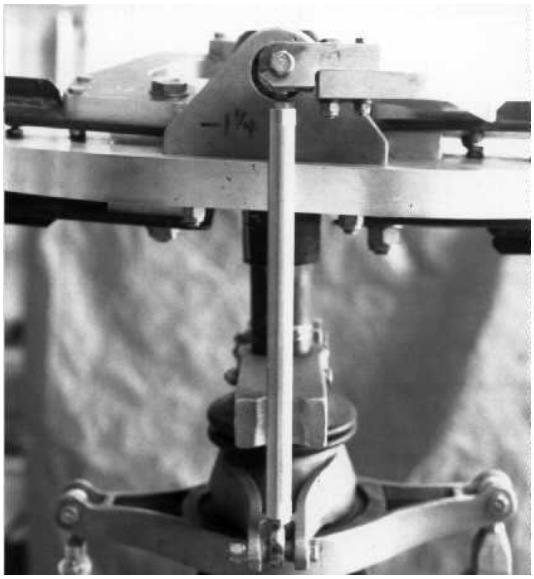

Photo #59

Install the control rods and adjust them so that the swash plate, rotor hub and both rotor blades are level.

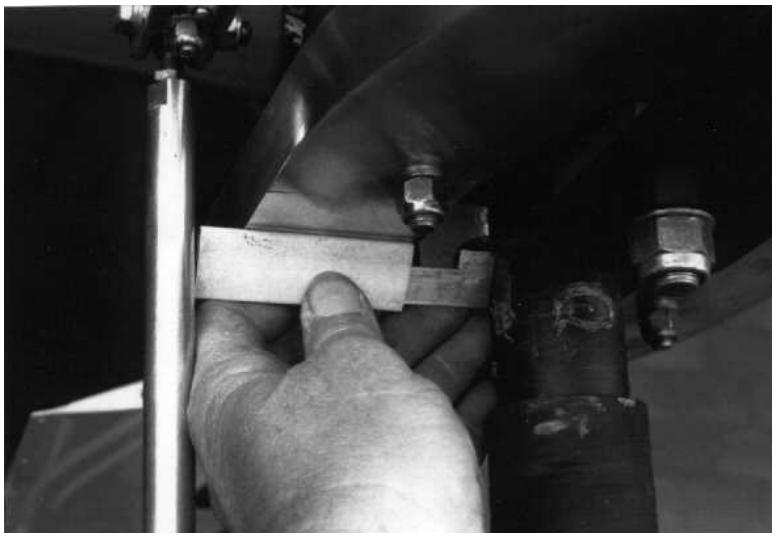

Photo #60

Slide the rubber collar down as far as possible and check the distance between the main shaft and the control rods; both sides must be equal. When all items in photos #58 and #59 are correct, the pitch horn is in the correct position. Use the holes in the pitch horns to locate and drill the two 3/16" holes in the straps.

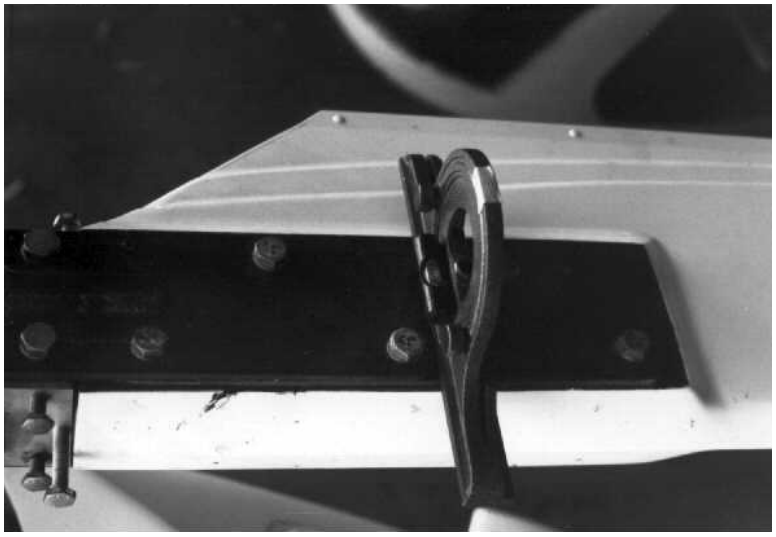

Photo #61

When setting the pitch on the rotor blade, the rotor hub and swash plate must be level. Collective down both blades 1-1/2 degrees negative pitch. Collective up both blades 9-1/2 degrees positive pitch. The collective and cyclic controls should not interfere with each other throughout travel.

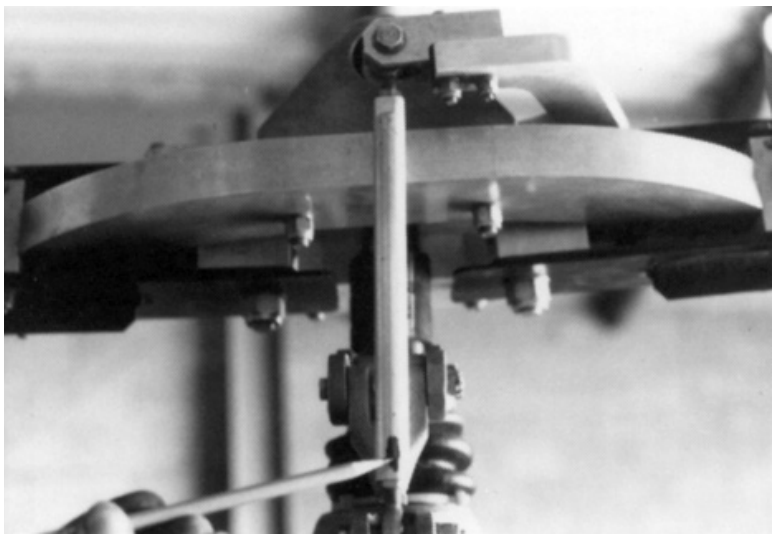

Photo #62

It may be necessary to change the track setting to make the blade track while turning, due to the aerodynamics of the airfoils. Make a tracking stick by taping a piece of rubber hose to a small diameter wooden dowel. Grease the hose and raise it until it makes contact with the turning blades (2 strikes minimum), 18" from the tip. Mark the control rods and turn 1/4 turn per adjustment, until both blades hit the tracking stick rubber.

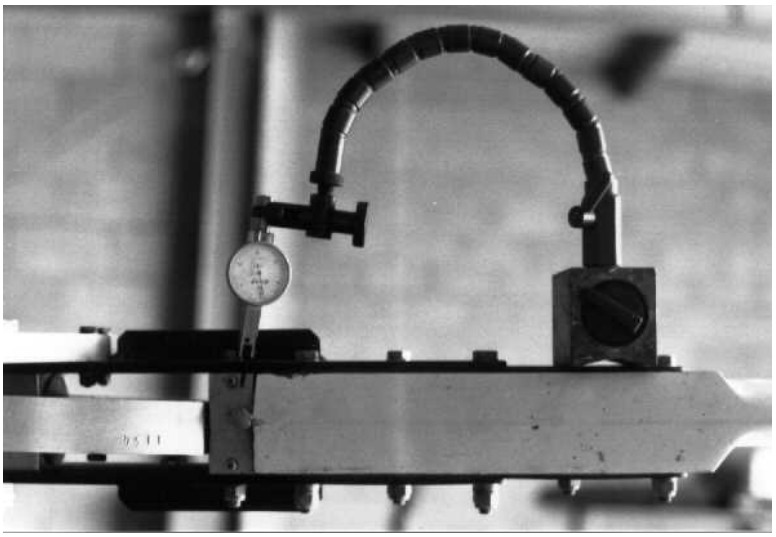

Photo #63

It may be necessary to change the static lead/lag adjustment to make the rotor balance while turning. When changing the lead/ lag on the dynamic test, set up the dial indicator as shown, with magnetic base on the longest steel strap and the indicator point on the aligner block. Move .002" per adjustment. Loosen the 5/16" lock bolts and set screws and turn the 1/4" all thread.

Photo #64

Use the reflex template and duck bill pliers to change the trailing edge angle for track adjustment in forward flight to maintain track and smoothness.