MODS AND FIXES

Mike Johnson

SCHLUTER CHAMPION

Early in 1986, SCHLUTER introduced the CHAMPION to offer a replacement for the SUPERIOR. Although there were many similarities to the HELISTAR and SUPERIOR, the biggest improvement was in the head design. The SUPERIOR style head was a good basic design, but the major flaw was in the collective input to the blades. The blade holder still was bolted to the thrust shaft which allowed the possibility of the blade holder turning on the shaft, causing the blades to go out of track. The new CHAMPION design utilized direct input to the blade holder eliminating the tracking problem completely. The flybar was placed below the main blades to simplify the construction of the head. The new CHAMPION head is very simple and functional design and has worked as well or better than any other head I've tried. The rest of the machine utilized many of the features of the HELISTAR and SUPERIOR. The side frames are of the straight HELISTAR type which offers maximum strength. The collective mechanism is ala SUPERIOR and very efficient. Overall, I give the CHAMPION the highest marks of all of any machine I've flown to date in its "right out of the box" state. However, as with any Machine, there are modifications or "fixes" that can be done to make this as close to the "perfect" machine as can be achieved. The following actions are the result of hours of "R & D". The goal was to make the machine as reliable as possible to insure the maximum learning curve. Some of the mods can be made at little or no expense, some do cost the bucks but are well worth it. Enough said . . . . let's get at it.

You might have had an opportunity to read Ray Hostetler's article in RCM, a couple of issues ago. Frankly, Ray is a very talented writer. His articles are the first thing I read. I've cut out every one he's written. His knowledge of full size helis has greatly enhanced his knowledge of our models. His article on CHAMPION in RCM was excellent as it covered every subject well. However, many people have called to ask if I agreed with some of his views. Let's talk about it. "Do not use the (flybar) paddles full length" writes Ray. He contends the downward force of the air from the main blades causes the heli to oscillate in the fore/aft plane. The fore/aft oscillation is really the result of the lack of lubrication in the "0" ring dampners in the head. This same problem has been described by GMP in the COBRA and COMPETITOR. By simply lubricating the rubber or placing a spacer or two (#1585) between the rubber "0"ring and the bearing (#1552) to decrease the pressure on the "0" ring, the dampning can be adjusted to elimate the fore/aft cycling. I have also experienced this problem if the head speed problems with the paddles. I fly my CHAMPION with the full paddles. I'm sure the length of the paddle can be adjusted to one's personal abilities but I suggest to start with them long first. Be sure to use the flybar weights.

Ray makes mention that there are eight bolts provided to hold the auto clutch to the main gear. "Eight bolts to hold the auto clutch to the main gear is ridiculous!" I believe the eight bolts are provided to actually adjust the runout of the gear. I use all eight in mine. Please refer to the picture for runout detail. Ray also comments about the fuel fittings leaking. Again, I have never had that problem.

I did experience a problem with the fuel tank that Ray did not mention. Many of the tanks I've seen in the CHAMPION have broken or developed leaks. Part of the problem was all the holes that needed to be drilled in it. Also the main carb pickup is mounted in the bottom (front) of the tank. This is a very weak area and the fitting does not provide a good seal. Almost every machine I've seen leaked there. I have tried every adhesive and filler but nothing sticks to the tank – Silicon, CA glue, Epoxy – nothing worked. Finally, I decided to work up a mod that would solve the problem once and for all. The hobby shop provided me with a thin flexible sheet of copper. I cut out two pieces approximately 55mm x 35mm as shown and drilled two holes with a 5mm drill. Bend the top piece as shown and solder the two fittings flush to the inside plate. Before soldering the vent line, bend it around a little more so as to install a short piece of fuel line against the top of the tank. Mount the assembly to the side of the chassis just above the tank. The two larger holes in the outer copper piece can now be cut in the tank. Now insert the soldered inside piece so that the threads on the fittings face out, through the tank. Insert them through the holes in the tank. Using a little LOCKTITE, tighten the nuts onto the fittings. The tank is now "sandwiched" between the two copper pieces and seal the tank without any need for adhesive. This arrangement will also hold the tank in place. This "mod" seems to have handled the problem.

It is sometimes difficult to get to the nuts that hold the chassis brace #3109 just above the rear of the tank. I use JB WELD to attach the nuts permanently to the brace. I have also seen a lot of CHAMPIONS that run great through the first half of fuel then have all kinds of engine problems in the bottom half tank. This is caused by the sharp end of the fuel fitting cutting through the fuel line causing the engine to suck air and run lean. The above fix along with the use of a heavier fuel line will eliminate this problem. If you use the heavier line it may be necessary to weight the clunk to keep it always in the fuel. This is especially true if you do aerobatics or inverted flying. Before installing the fuel line on the clunk, place a couple of heavy nuts on the shaft of the clunk, then slide the fuel line down the shaft and tighten against the nuts.

One area that I am in full agreement with Ray is the tailboom. He suggests that SCHLUTER has a problem with the tail rotor drive wire "whipping" inside the tailboom. By adding more plastic tail wire bushings inside the tailboom, his line: "this is merely a bigger bandaid" is quite appropriate. He suggests a copper guide tube inside the bushings. Indeed, that is just what I did. Simply punch the plastic bushings out of the tube with a piece of 5/16th's dowel. Drill the center hole of the plastic bushings out to 1/8th inch on your drillpress. Using a bolt or a small screwdriver in the center lube hole, use the dowel to push the plastic bushings back into place just outside the lubrication holes. Now insert a 1/8th OD piece of copper tubing cut to the right length in the tailboom, through the plastic bushings. Drip some thin CA down into the lube hole so as to glue the brass tube to the bushing and the bushing to the tailboom. Spray a little accelerator into the holes so the CA will go off. Since these holes will no longer be used, you can turn the tailboom over and re-drill the two small horizontal fin holes. Now grease the drive shaft with BOSCH grease and insert it into the brass in the front of the boom. Mount the boom to the chassis after inserting the tail wire into the drive shaft slot. Many people are experiencing problems with the tail boom slipping. Drill a hole for the short sheet metal screw between the boom supports #389. This will help keep the tailboom in place.

I have seen some of the ballinks in the head come loose. Any threaded ball in any R/C heli application should be RED LOCKTITED. This is especially true in the CHAMPION. Refer to part numbers 434 and 3400 in the head swashplate.

The output wheel on the fore/aft cyclic servo is utilized as a push/pull input. This requires 2mm forward differential. Refer to the diagram.

Ball Bearing Applications

I highly suggest using ball bearings #282 in the bellcranks and tha tail rotor bellcrank. These bearings are about $10 each and ten are needed. This makes the action of the bellcranks so smoooooth and very reliable. The SUPERIOR style double bearing blades holders should also be utilized to keep any lateral play out of the tail rotor blades. Use the new bearing shaft #396.

Getting the Vibration Out

I recently built a new CHAMPION which flies very well but has a tremendous problem with foam in the fuel. As you can imagine, this can cause all kinds of engine problems, not to mention my disgrace when I show up at the flying field. Furthermore, vibration in the fuel can cause serious radio problems, cause stress cracks, and all kinds of other related problems. This foaming had to go.

Vibration in the fuel is usually caused by a misalignment in the drive train; in the extremities by an imbalance in the head. With this in mind, I proceeded to check and super-tune all the components in the drive train. First, the engine was removed and the flywheel/clutch/starter shaft were all re-aligned to within .001 inch. Generally, the accepted tolerance there is .003 inch, but I needed to be sure each time was perfect so as to isolate the problem. The assembly was installed in the machine and hovered again. The fuel still foamed. As mentioned in an earlier newsletter, the main drive gear has eight bolts that attach the A/R gear to the main gear. These bolts are there to adjust the runout of the main gear. This gear was then removed and the runout adjusted to within .002 inch. The machine was hovered again and still the fuel foamed! Back to the drawing board.

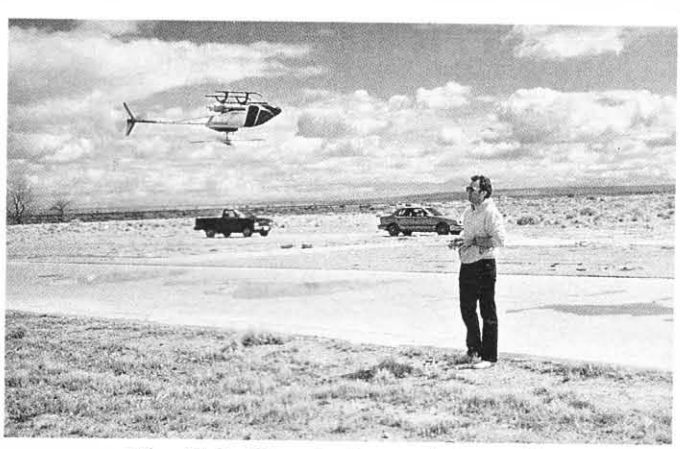
Upon close inspection with my magnifying glass, I found that the collar (#261) that retains the tail rotor drive shaft was touching the top of the main drive gear (#1269). There was even a mark on top of the main drive gear where the collar had been riding on it. Upon inspecting other CHAMPIONS I found this to be a common problem. This was solved by placing 3 shims between the gear and the lower bearing. This provided about a .010 inch space. Sometimes just turning the main gear over will solve the problem. If you rotate the main gear while eyeballing the space between the gear and the collar, you can see any wobble in the main gear. This can be adjusted as mentioned before by tightening and loosening the eight bolts. The heli was again hovered and even though the foaming was noticeably better, it was still there.

The engine alignment was the next suspect, so I removed the starter cone, the top bearing block, the left side threaded bolt for the F/A bellcrank (#3111), and the bottom bearing block. Then the top block was installed over the top of the starter shaft and allowed to sit on top of the side frames. Sure enough, it was off to the side as shown in the drawing. To remedy this, the two engine bolts that hold the engine to frame had to be loosened just enough to allow adjustment. The height of the engine in the chassis determines the amount of up and down play in the clutch housing when the lower bearing block is installed. There should be about .002" play. Be sure this is correct before you proceed. Use a razor blade to make a mark on the sideframe just above the engine mounting bracket. This mark can be used for future reference when doing the other engine adjustments to follow. Now slip the upper starter shaft bearing block down over that starter shaft until it rests on top of the side frames. Adjust the slant of the motor until the bearing block is centered over the side frames. Now tighten the bottom bolts that hold the engine bracket to the side frames. This can require four hands to perform this operation: two to tighten the bolts, and two to hold the engine assembly straight. Now both bearing blocks should be centered between the frames. Re-install the blocks and the F/A shaft (#3111). Double check the up and down movement of the clutch housing (#267) to be sure you have to the tolerance. The alignment is complete if the head of the engine is centered between the side frames. After completing this the heli was flown again. Still better but .... still foam!!

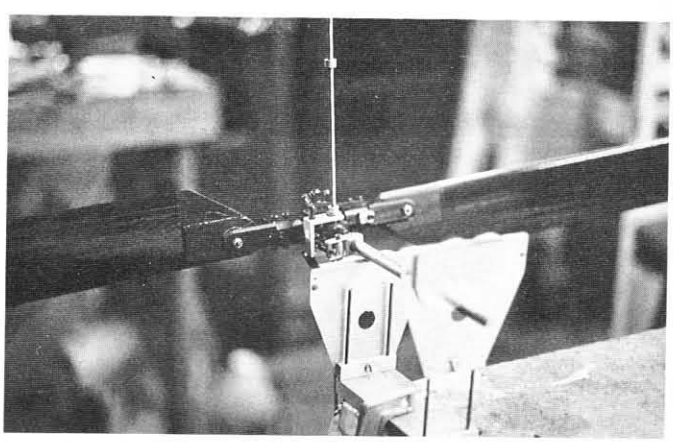
By now I was pretty stymied. The only thing left was the main shaft. Could it be bent? I removed the shaft and checked the runout. Sure enough, it wobbled by .014". I pulled another brand new shaft from the shelf and it was out .012". Ten more shafts were tested for runout, brand new – right off the shelf, and they ranged from .001" to .016"! I guess .016" is within the factory tolerance, but I chose to use the .001" shaft. Once more the machine was hovered. Now the fuel foamed down to 3/4 tank and the foam seemed to 80% disappear. This was still intolerable. Now Walt Schoonard was consulted. He recommended that I shim the head of the engine to lower the compression. So I pulled the engine again and installed the shims. The shims did seem to help a little, but not enough to justify the loss in power. Finally, I removed the tail boom and the tail rotor gear box to totally eliminate any chance that they could be contributing to the problem. Then the heli was bolted to a bench and run up again. Would you believe – still foam in the fuel!!!

At least I can boast the most perfect drive train in existence. All parts of it are absolutely perfect. It seems to me that if we are going to build an R/C heli it should be as perfect as can be. In that spirit I have no regrets for going through the exercise. Now every CHAMPION I see is inspected for these alignments. After all, in our quest for the perfect machine, these adjustments are the very least we should accomplish. Well, even after all this I still have a machine that vibrates. The only place left to look is in the head, but that's a different story. Needless to day, if it ain't broke – don't fit it! However, if you do have some vibration in the fuel go through the above procedures one by one to isolate the problem.

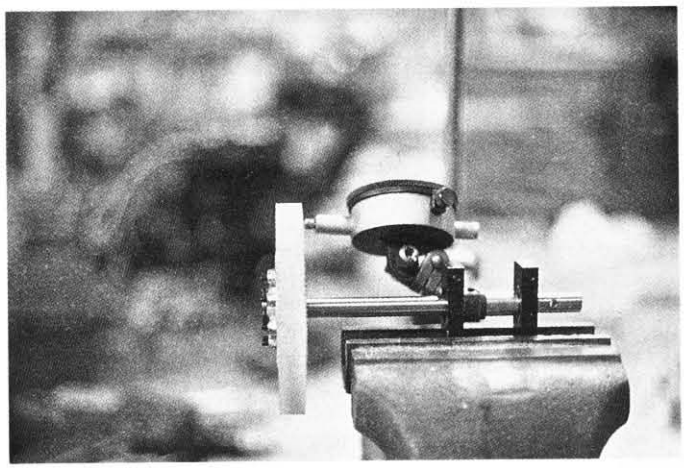
Vibration in the extremities such as the landing skids or the tail skids is usually diagnosed as an imperfection in the balance of the head and blades. However, since I was convinced that any potential problem in the drivetrian had been remedied, the head was the only place left to look. I wanted to be sure that ▷



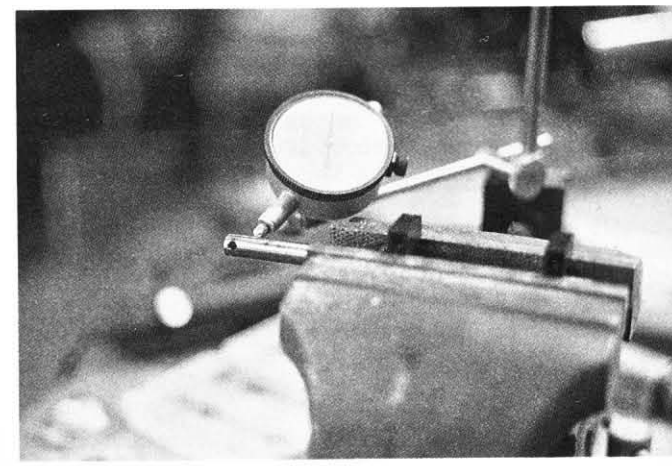
Mike with the Champion in a steady inverted hover.



Balancing rotor head and blades. Notice the lead on right hand blade holder.



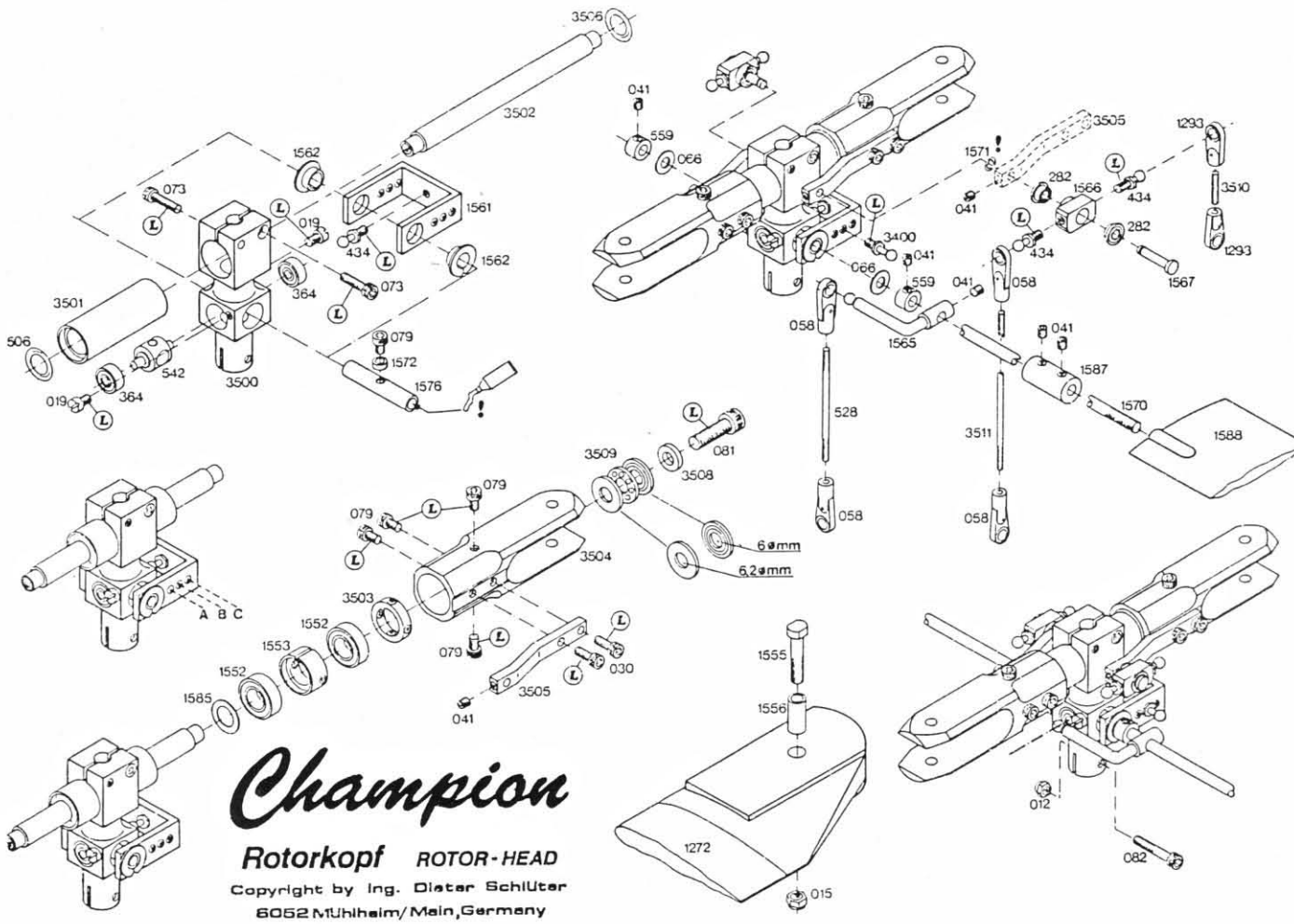
Checking maingear runout.



Checking mainshaft runout.

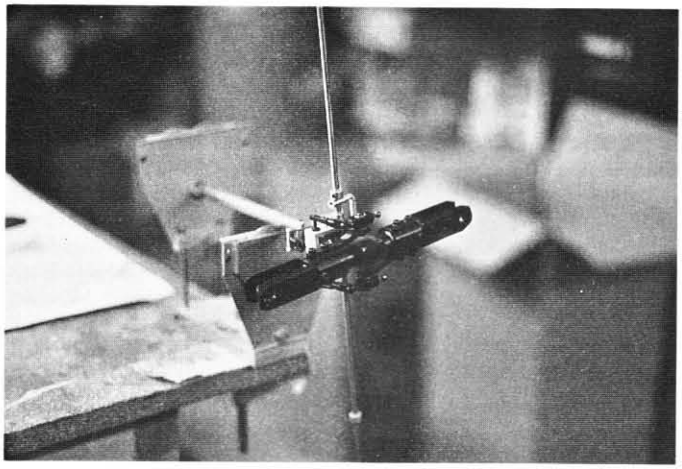
◁ improper placement of the lead or any other modification to the blades was not contributing to the vibration problem. Therefore, stock unweighted blades were chosen. One of the problems encountered with the SCHLUTER type collective system is the built-in imbalance in the head due to the collective bail #1561 and the follower (numbers 1289 thru 1293) protruding out on one side with nothing to counteract it on the other. This is usually overcome by adding weight on the opposite blade to balance the system. If the head on your CHAMPION is not balanced, I'll bet you have additional weight somewhere on the opposite blade. By adding this weight, you not only throw off the CG of the blade, but you increase the total mass of one blade more than the other which can only contribute to the vibration. Make sense??? Then let's proceed to balance the head.

All balancing should be done on the HIGH POINT BALANCER with the follower installed in the flying position and perpendicular to that shaft. (See the photo) Start by removing the 3mm bolt (#079) on the opposite blade holder from the follower and collective arm. Notice the small 2mm hole right next to it. This will be used to "Key" the small lead weight we're going to add. Now obtain some soft lead weight from the local hobby store and cut it to about 15 x 10 x 4mm. Next drill a 3mm hole in one side to accept the 3 x 8mm screw (replacing #078) which will hold the lead to the blade holder. Measure the distance from the center of the threaded hole in the blade holder to the small hole right next to it. This should be about 4mm. Drill a 2mm hole and press fit or thread some 2mm stock into lead. This will act as a "key" as mentioned earlier to keep the lead from moving in any way. CAUTION!!! Be

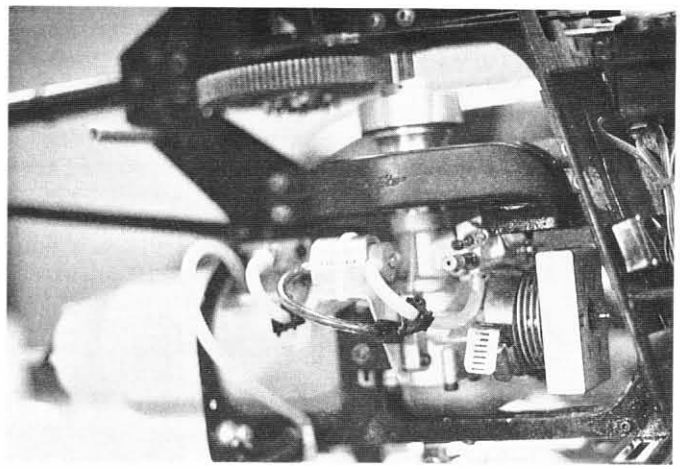


Champion

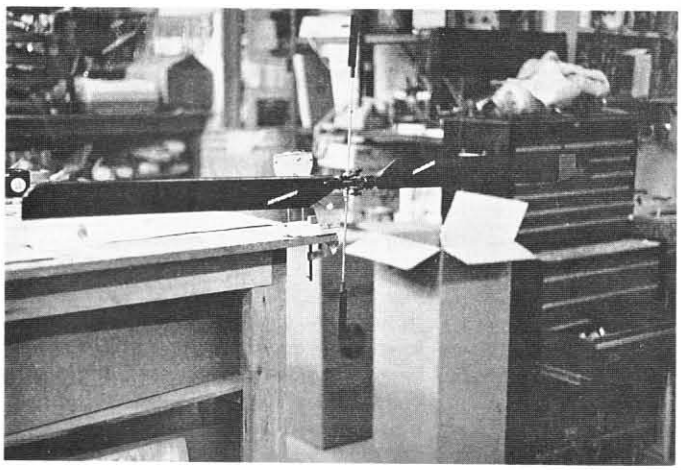
Rotorkopf ROTOR-HEAD



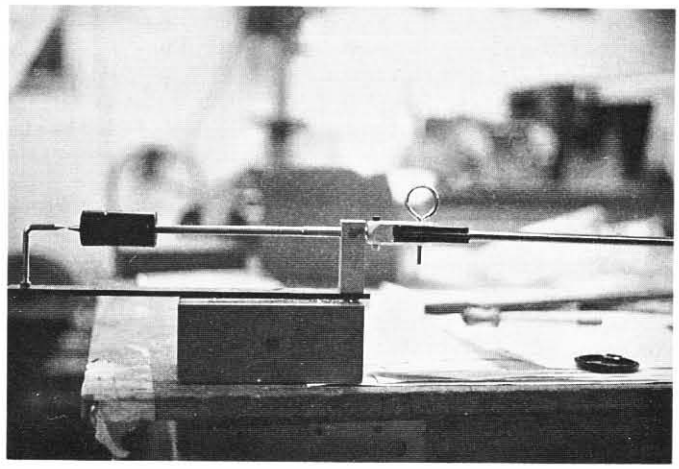
Balancing just the head with follower.



Perry Pump installation.



Balancing the entire head and blades.



Using the Schluter Balancer.

sure this lead is securely held in place before flying as it would certainly make a deadly projectile if it were to come loose. Use a 5mm O.D. washer under the 3 x 8 bolt. The washer will cover the "key" and keep it in place. Screw the 3 x 8 bolt into the blade holder. After the balancing is completed, you could even use a little epoxy or red locktite to help secure the lead. Place the head with the collective arm and the follower on the HIGH POINT as shown in the photograph. Trial and error is used to slowly cut the lead with a razor blade until perfect balance is achieved. I even got down to using fine sandpaper to remove small amounts of lead to achieve balance. Once you are happy with the balance, secure the lead with locktite or epoxy as described above.

Now, utilizing a SCHLUTER blade balancer, balance the blades to each other using small amounts of CA glue to weight the lighter blade. Be sure to CG the blades before covering. Refer: **Hover Hints-Blade Methods.** I choose to use the stock stick covering. After covering the blades balance them again on the blade balancer. Place tracking tape on the light blade. Before installing the blades, balance the flybar on the head with the HIGH POINT using a 5/32 wheel collar on the opposite side from the control arm #1565. The balance should be achieved with the flybar weights all the way out against the paddles. Move the collar in or out along the flybar to perfectly balance the flybar. Next, install the blades on the head and tighten them so they will stay straight. If the head balances, and the blades balance, then the whole assembly must balance. If it doesn't, go back and re-do the procedure on the head and blades. The whole head/blade system with the collective arm and the follower perpendicular to the main shaft should now balance in any position on the HIGH POINT.▷

Champion Set up

	Low Position Normal	Low Position Throttle Hold	Low Position Invert	Hover Position Norm. 1/2 Stick	Hover Position Invert	High Position Norm.	High Position Throttle Hold	High Position Invert	Throttle Position @ 1/2 Stick
Stock	−2°	−4°	+2°	+4°	−4°	+7° to +8°	As much as you can get	−7°	50% – 60%
Stock W/Lead (1 oz per blade)	−2°	−4°	+2°	+4 1/4°	−4 1/4°	+7° to +8°	As much as you can get	−7°	65%
Techna 1 ® (Leaded)	−2°	−4°	+2°	+3 3/4°	−3°	+8°	As much as you can get	−5° to −6°	60%

Graphic by R.S. Cashman

After installing the new "Super Balanced" blades and head on the machine, I went out to check it all in the hover. What do you know! The fuel in the tank was absolutely calm. A set of Techna I ROTOR-SPORT blades were then installled and a little foaming was acquired. By simply re-CG-ing the blades the foam was removed.

SETTING UP THE HEAD

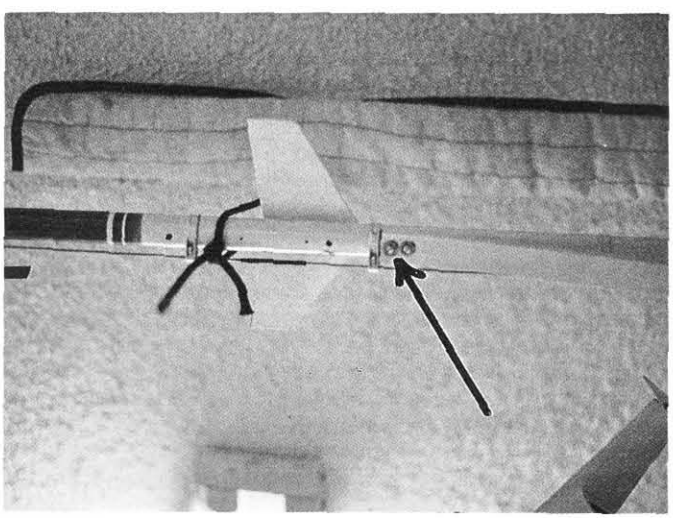
The new JR GALAXY heli radio is currently installed in my new CHAMPION. This is the most perfect heli radio I have ever used! A review of this radio is very much warranted and will follow soon. The normal flying position is achieved by installing the input balls in the center holes of the collective arm #1561. This will give about 12 degrees total throw and is perfect for FAI or AMA expert pattern work. It is also the perfect position for the beginner. The outer holes are used for inverted and aerobatic flying. This setting will produce about 18 degrees total throw or minus 6 degrees to plus 12 degrees. Consult the chart for the collective positions for the type of blade you are flying. Stock blades fly best at about 50 to 55 percent at the hover position. Leaded blades need about 65 percent throttle at the hover position. The TECHNA I blades I am now flying require about 60 percent throttle at the hover position due to the lower drag and 3¾ positive at hover. Remember, these are just starting positions. Nothing beats a good digital tach. I have found that the stock blades fly great at about a 1750 rpm head speed. The leaded TECHNA'S fly great at 175 grams and 1850 rpm head speed. I am looking forward to trying some of the new fiberglass blades. Be very careful of the blade weight and head speed when trying these new blades. SCHLUTER recomends that you not exceed 160 grams total blade weight. I've heard of some people flying fiberglass blades up to 250 grams! I'm sure a 200 gram blade weight and a 1900 plus head speed could be deadly so use extreme caution. I ve recently seen some CHAMPION heads that will not maintain tracking. The two main causes are: 1) The blade bearing shaft #3502 is bent. Remove the main blades and insert an allen wrench into one side of the blade holder retention bolt #081. Observe the other side bolt to see it there is any runout in the bolt. Repeat this procedure on both sides. If in doubt, remove the shaft completely and roll it on a glass table or similar smooth surface to see if it wobbles. Be sure upon re-assembly that the thrust washers (6.0mm and the 6.2mm) are in the correct order. If you are building a new CHAMPION check these anyway as I have seen some new heads right out of the box incorrectly assembled. 2) The main blades are mounted too loosely in the blade holder. I like to snug mine down then run the head up to hover speed for a minute or so. Then I let the head come to a complete stop all by itself so as not to disturb the blade setting. Then I tighten the bolts down so the blades cannot move in the blade holder. Locked down blades put less pressures on the collective servo. If you have a blade strike you will do more damage to the head so if you're a beginner, just leave the bolts snug. Also be sure both blades have about the same tension in the blade holder.

FLYING THE CHAMPION

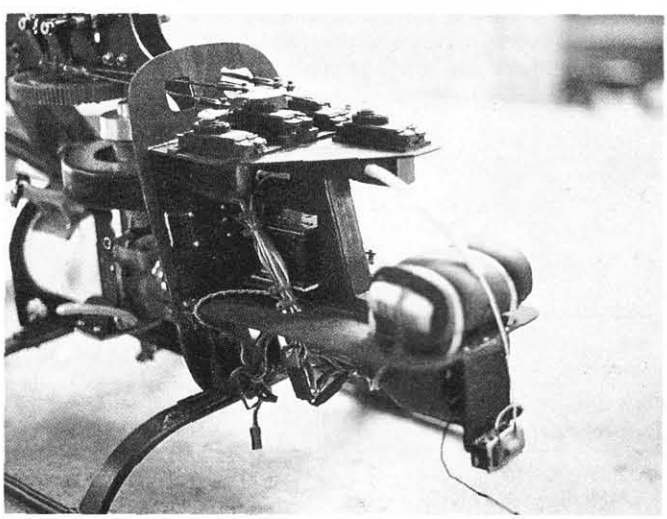
This is a most enjoyable machine to fly. I am flying a JMW gyro with duel rates and 7.2 volts center taped to 4.8 volts for the reciever. With the battery pack mounted as far forward on the tray as possible, the machine balances about ¼ inch in front of the main shaft without the canopy. I am flying a SUPERIOR canopy which really adds to the asthetics of the main and much more aerodynamic. My nose in manoeuvres has improved 100% with this set-up. Utilising the TECHNA I blades and about minus 5 degrees in the hold position, the autos are spectacular! These blades will let you enter the auto from almost any position: downwind, 360 degree autos, autos from the loop or straight down autos are all performed easily with lots of RPM to spare at the bottom.

Rolls and loops are a cinch with the full length paddles. I am still in the process of testing other paddles. The stock paddles do make the machine very sensitive in the fore/aft while in fast forward flight. The one to one kit (#319) in the tail rotor works very well in the backwards flight manoeuvres. I am using the wooden GMP tail rotor blades to lessen the stresses on the tail rotor blade holders. We are also experimenting with the HEIM tail rotor assembly for increased tail rotor precision. The real joy with this machine is the inverted flying. The heli is so easy to set up for inverted that flying is s cinch. The hardest part is looking at the bird, as it looks so weird upside down! Trying to figure out what to fly, the disk, the skids, the tailboom, or the canopy is the hardest part. I've had the greatest luck flying the disk. One problem often encountered while learning inverted flying it that when the machine is brought down into the inverted hover, you may not have enough negative (that's positive when your inverted!) at the full T/C stick position. There you are in your first inverted hover and the heli won't climb! Now what? Transition the machine into the wind and it should climb until you get enough altitude to roll it over. Add some more top end inverted pitch before you try it again. I can tell you it can be a very sick feeling to be inverted three feet off the ground and the machine won't climb so take care. You should be able to hear the blades lug just a little while your flying around inverted at altitude at full T/C stick.

So far I have about fifty flights on my CHAMPION and there is no apparent slop anywhere and the swashplate is still solid as a rock. Other than a muffler separating from the machine (which was solved with a special bracket) I have had no real problems. Efficiency in heli flying requires that we be able to identify problems quickly and perform the appropriate fix. I hope this text will help you do that and greatly enhance the reliability of your machine.



Tail boom mount detail and tail rotor pushrod joint.



The Champion front end with Deans Antenna.