John Thema

$3.50

ASSEMBLY and *FLYING*

INSTRUCTIONS

"DU-BRO WHIRLYBIRD 505"® **RADIO CONTROLLED** HELICOPTER KIT

designed and manufactured by

DU-BRO PRODUCTS INCORPORATED

wauconda, illinois 60084

U.S.A.

INDEX

INTRODUCTION

Since helicopters are so new to the radio control field, and all copters including the full-sized ones, are very dependent on everything working perfectly, we strongly advise you to read and follow all instructions. If you deviate from any of the prescribed steps or try to change the engine size, props, weight of model, or any other parts, then you are on your own. If, however, you build this kit as we have described, you should have no trouble learning to fly it. After you learn to fly the model, you can start to modify it and try your own ideas. It is suggested that you read the instructions completely and study the drawings and pictures before starting constructions. If you use the written instructions for assembly procedures, the exploded view drawings for part identification and location, and the pictures to see what the assembly should look like when finished, you should have no trouble building this copter.

WOOD FRAME ASSEMBLY

1. Install bearing blocks in side rails. (Top block hole up, bottom block hole down.) Note mark on one end of each bearing block. Install blocks so that the marks are on the same side. See Drawing A for part identification. Use white glue on all wood joints except where noted. Sand all wood parts before assembling.
2. Glue landing gear block in place.
3. Glue servo mounting plate in place. You may have to sand the thickness of this plate in order to press it into the slot of the landing gear block.
4. Glue servo mounting rails in place. (Adjust to fit your servos.) See Pix #1. After installing rails, fit servos in place. If you are using some of the larger servos, you may have to cut out some of the side rails so that you have about 7/16" between the servos.
5. Glue tail boom mounting plate in place.
6. Glue tail boom mounting block in place. Be sure the small hole is on the left side as you face the front of the copter. See Pix #2.
7. Round top 1 1/2" edges of side rails so plastic body will fit.

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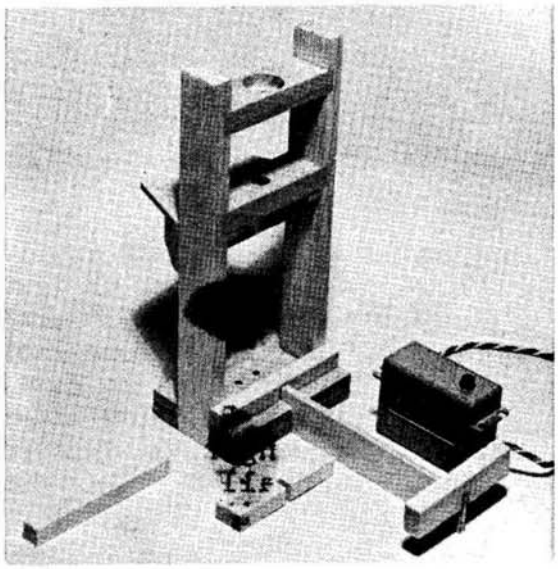

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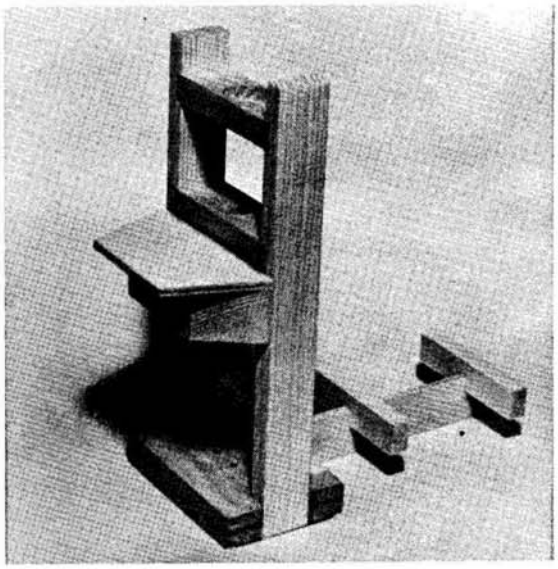

TAIL BOOM ASSEMBLY

1. Bend tail rotor protector wire to shape as per Drawing B. Use 14" long 1/16" wire provided.
2. Glue protector wire in place using the wood button plug. You may have to square off the end of the tail boom with sandpaper. Make the first three bends and insert the wire through the boom and make last bend. Epoxy wood plug and wire into tail.
3. Trim plywood fin to fit protector wire.

4. Mount fin in place using soft copper wire. Drill small holes in plywood along edge of protector wire and lace plywood fin to protector wire. See Pix #3.
5. Epoxy fin to wire and tail boom. See Pix #3.
6. Glue stab on stab mounting block. (Use white glue.) Be sure to put block in center of stab.
7. Trim stab mounting block to fit over the tail rotor protector wire.
8. Epoxy stab onto tail boom. Be sure it is square. See Pix #4.
9. Make tail rotor drive shaft guide using 1/16" collar, 4-40 stud made by cutting the head off a 1 1/4" x 4-40 bolt, and 1/2" brass tubing. Screw stud into collar and slip tubing on stud. Hold in place with 4-40 nut and solder tubing to collar. Remove nut. See tips on soldering.
10. Mount guide on tail boom using small 4-40 nut. Be sure hole for shaft is in line with the tail boom. Trim excess [illegible] and epoxy to boom.
11. Mount tail rotor control wire guide in place using two 2-56 nuts. See Pix #5. Be sure hole in end of guide is lengthwise with tail boom.
12. Epoxy [illegible] nuts to tail boom.
13. Sand tail boom for good fit into tail boom mounting block.
14. Epoxy tail boom in place in block. Be sure tail boom is straight and in line with the main frame. See Pix #6.
15. Sand and give three coats of clear dope to all surfaces. Then spray on color.

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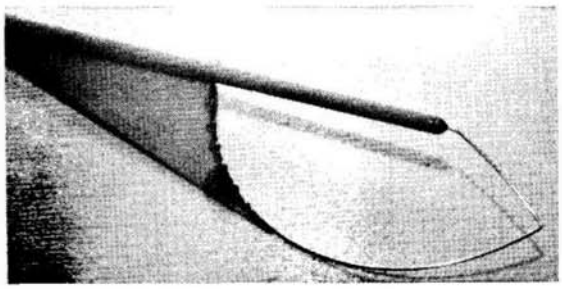

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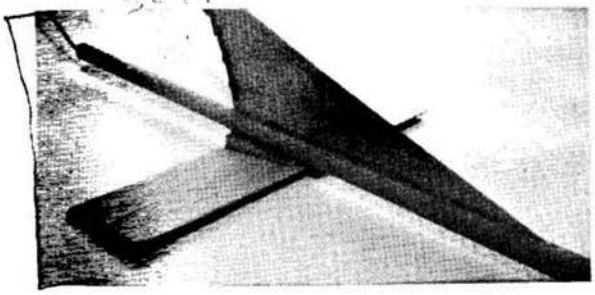

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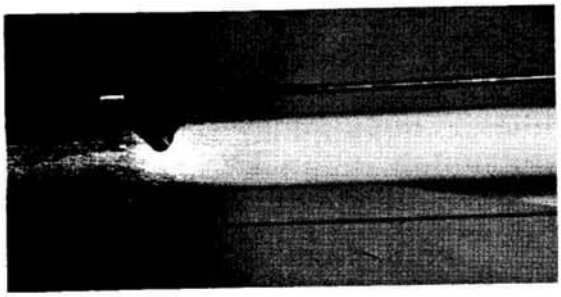

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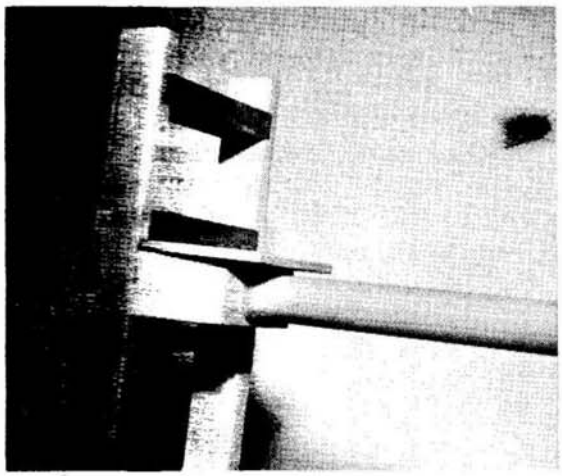

TIPS ON SOLDERING

Use a good grade of resin core solder on all joints. Also use a good soldering flux on all joints. This makes a much better joint. You should use a 150 to 250 watt gun or iron. Be sure to clean all joints with lacquer thinner to remove any flux. For a good solder joint, use plenty of heat and not much solder. A good joint will be smooth and shiny when finished.

LANDING GEAR ASSEMBLY

1. Burrs should be removed from all wire parts before assembly.
2. Slip landing gear wire in place in landing gear block. (Do not screw down at this time.)
3. Fit landing skids onto wire with turned up end in front.
4. Solder skids to wire. Use flux to get good solder joint. See Pix #7.
5. Carefully remove landing gear from block and paint.
6. Install landing gear in block and screw down using the four steel brackets and 1/2" sheet metal screws. See Pix #8.

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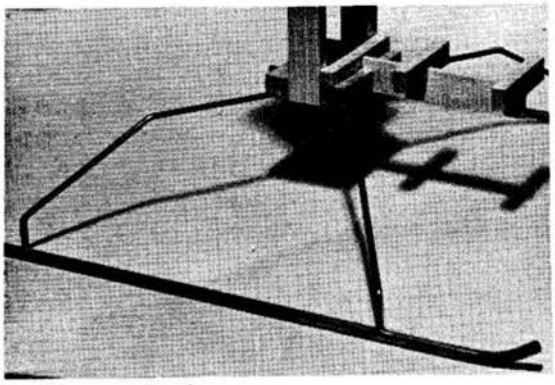

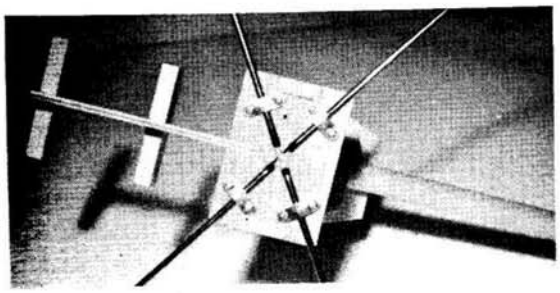

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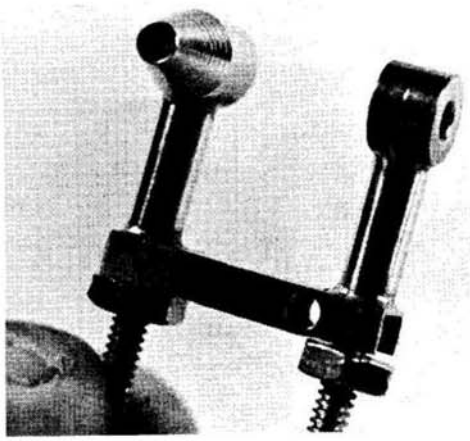
TAIL ROTOR ASSEMBLY

1. Study Drawing C carefully before starting assembly for part identification. All burrs should be removed from all brass tubing and brass parts before assembly.
2. Cut the head off one of the 1 1/4" 4-40 bolts and file the end of bolt flat to make a stud. Screw 4-40 stud into drive shaft support collar. Be sure the 3/32 x 5/8 brass shaft bearing will slip through hole in collar.
3. Slip 3/8" brass tubing over 4-40 stud. Hold in place against collar with 4-40 nut and solder tubing to collar. Then remove nut.
4. Now slip this assembly into the channel mounting plate. Hold in place with 4-40 nut. Do not solder at this time.
5. Make stud from another 1 1/4" 4-40 bolt. Screw 4-40 stud into prop shaft bearing. (Be sure stud is not in too far.)
6. Slip 3/8" brass tubing onto stud and hold in place with 4-40 nut.
7. Solder tubing to bearing and remove nut.
8. Slip this assembly into channel plate and hold in place with 4-40 nut. Do not solder at this time. See Pix #9.
9. Slip the drive shaft bearing into the support collar and then using a short piece of 1/16" wire for the drive shaft, line up the support post with the channel plate and solder the post to the channel.
10. Mount the nylon gear on the short wire you are using for the drive shaft.



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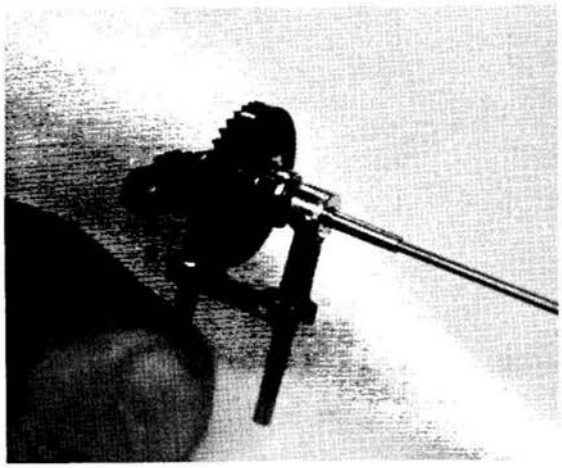
11. Slip the prop shaft with small brass gear into the shaft bearing and line it up 90 degrees to the channel plate. Check to see that the two gears mesh properly and solder the bearing post to the channel plate.

12. Now slip the drive shaft bearing in against the nylon gear until the two gears are properly meshed (not too tight) and solder the bearing to the collar. See Pix #10.



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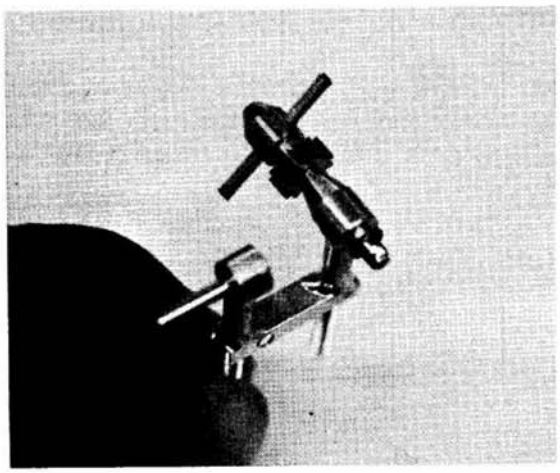
13. Using one of the 1" 2-56 studs, make two 3/8" studs. Cut the stud off, file flat and run a 2-56 nut over the threads to straighten them. Screw the cut off end into the prop shaft all the way and very carefully solder the studs to the shaft. Very little solder is needed. Do not get too much solder into the threads of the studs. After soldering, you can clean the threads by screwing a Kwik-Link onto the studs. The links must rotate free on the studs.



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14. Slip the prop shaft into the bearing and force the small brass eyelet over the end of the shaft. Don't make it too tight, shaft must rotate freely. Solder eyelet to shaft using very little solder. Clean all solder joints with lacquer thinner to remove flux. See Pix #11.

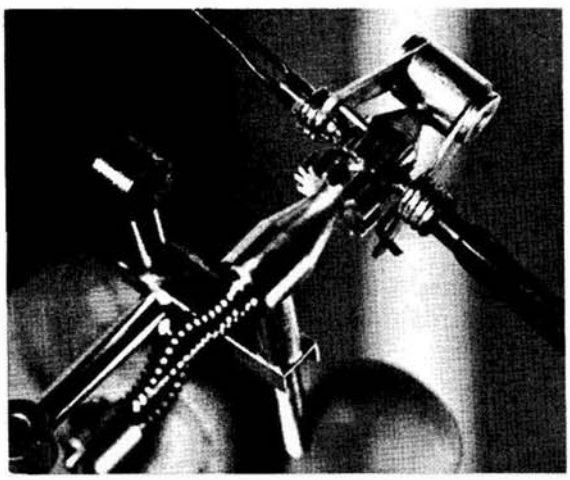
15. At this time, check to see that the gears turn freely by turning the drive shaft. If gears do not turn freely, check all alignment and joints until the assembly turns freely.

16. Mount the two blade pitch control arms on the brass pitch control head and hold in place with small brass washers. Very carefully peen over the brass studs to hold the washers in place. (Do not solder because you will solder the arms too.) The arms must move freely.

17. Solder the control head to the 2" x 1/16" wire shaft.

18. Twist the spring like blade control arms onto the two Kwik-Links which have been flattened. See Drawing C. Note one arm is bent in and one is bent out. The one that is bent out should be twisted all the way on and flush with the end of the Kwik-Link. The arm that is bent in is not twisted all the way on. Leave about 1/2 of the last turn of wire overhang the Kwik-Link. After installing, cut off excess wire on the arm which is going to fit into the pitch control arms. The wire should be about 1/16" long.

19. Adjust the arms on the links. The arms must be parallel with the blades and both arms should be in the same place in relation to the blade. See Pix #12. Very carefully solder the arms to links. Just tack solder do not try to completely cover the spring with solder because solder will get into the threads of the Kwik-Link.



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20. Screw the Kwik-Links onto the 2-56 studs on the prop shaft. Screw them all the way down. Then back off until they rotate freely.

21. Slip the pitch control head shaft into the prop shaft, put spring on over the shaft and down onto brass eyelet. This spring is the shorter of the two straight springs. Hold spring in place with collar on end of pitch control shaft. See Pix #12. Adjust collar flush with end of shaft.

22. Slip the pitch control arms onto the blade control arms. See Pix #13.

23. To make the control arm assembly, screw 2-56 x 1" stud into 3/32" collar and slip 3/32" x 5/8" brass tubing through collar. Temporarily slip the L-shaped control crank into the brass tubing. (Do not solder any of these joints at this time.) Slip 1/8" x 5/8" brass tube over 2-56 stud.

24. Mount the control arm assembly into the channel plate and hold in place with a 2-56 nut.

25. Now move tubing up and down in the collar until the control crank will line up with the pitch control shaft. When everything lines up, solder the tubing to the collar and to the channel plate.

26. Now remove the 2-56 nut. Trim excess 2-56 stud and solder to channel plate.

27. Mount the pitch control bearing on the control crank with set screw. Position so pitch control shaft rides in center of bearing. See Pix #14.

28. Make stud by cutting head from 1/2" 4-40 bolt. Screw 1/2" 4-40 stud into collar, which has a tapped 4-40 hole on both sides, and solder. With set screw, mount this arm on the control crank so the set screw sets on the flat spot on the crank. See Pix #15.

29. Sand and round the corners of the tail rotor blades.

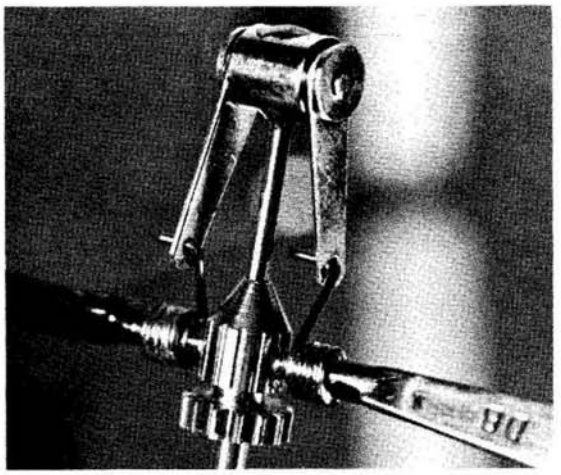
30. Slip the plywood blades into the Kwik-Links with the links in the center of the blade and in line with the length of the blade. Epoxy in place. See Pix #15.

31. Screw brass coupling on 4-40 1/2" stud to complete the blade pitch control arm and crank assembly.

32. Check to see that when you move the control arm, the blade pitch shaft moves in and out and the blades change pitch.

33. Sand and put on three coats of clear dope on the tail rotor blades.

34. Mount the tail rotor assembly on the tail boom by slipping the 4-40 studs through the two holes in the boom and hold in place with small 4-40 nuts. Cover nuts with epoxy to hold in place. See Pix #16.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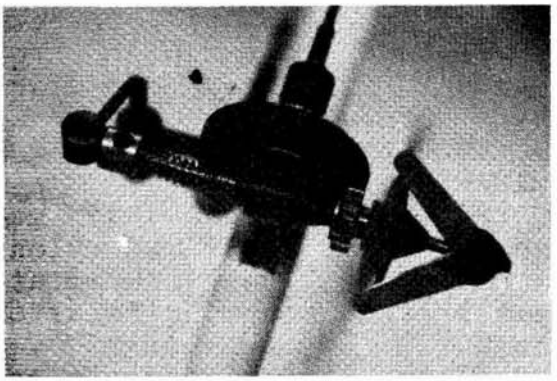
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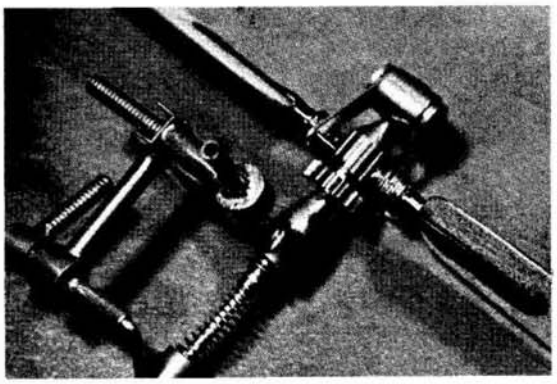
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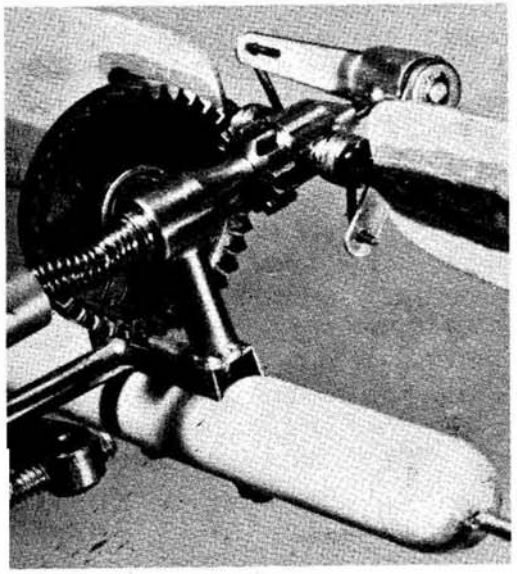
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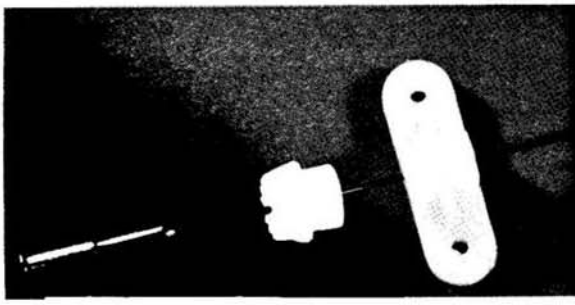
TAIL ROTOR DRIVE SHAFT

1. Solder the brass gear mounting onto the 1/16" x 24" drive shaft.
2. Slip gear on shaft and press gear in place on knurled brass gear mount. Be sure the gear is pressed on all the way to the flange and is facing the right way. See Pix #17.
3. Slip nylon shaft bearing onto shaft and slip shaft through shaft support bearing on tail boom. Do not put shaft into tail rotor bearing at this time. Push shaft through support bearing until nylon bearing will set on plywood plate over tail boom.
4. Press the two ball bearings into the holes in the two hardwood bearing mounts.
5. Slide the main shaft into the ball bearings with the large nylon gear on the shaft between the wood bearing blocks.
6. Lock the large gear on the shaft using a 1/2" 6-32 bolt.
7. Adjust the drive shaft gear and nylon bearing until the large nylon gear will mesh with the small gear and rotate freely. Then mark the two mounting holes on the plywood plate.
8. Remove the drive shaft and large nylon gear.
9. Drill the holes in the plywood plate with a #24 drill and install the two 4-40 blind nuts.
10. Put the drive shaft back through the support bearing and screw the nylon bearing to the plywood plate with two 4-40 1/2" bolts. See Pix #18.
11. Pull the shaft back as far as it will go and mark the length of the drive shaft which should be cut long enough to go almost to the prop shaft bearing (about 1/16" from it).
12. Remove the shaft once more and cut if off and file a flat spot on the shaft for the set screw in the nylon gear.
13. This time install the drive shaft through the support bearing and into the rear bearing and into the nylon gear. Mount the nylon bearing block with the 4-40 bolts and pull the shaft back as far as possible. Push the nylon gear as far forward as it will go and tighten the set screw onto the flat spot of the drive shaft. See Pix #19.
14. Check to see if the tail rotor turns free when you turn the bevel gear on the front of the drive shaft.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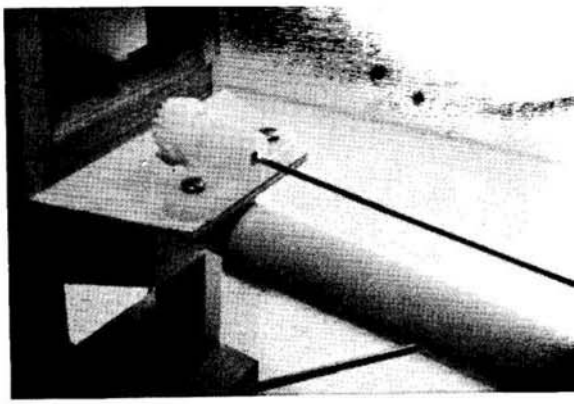
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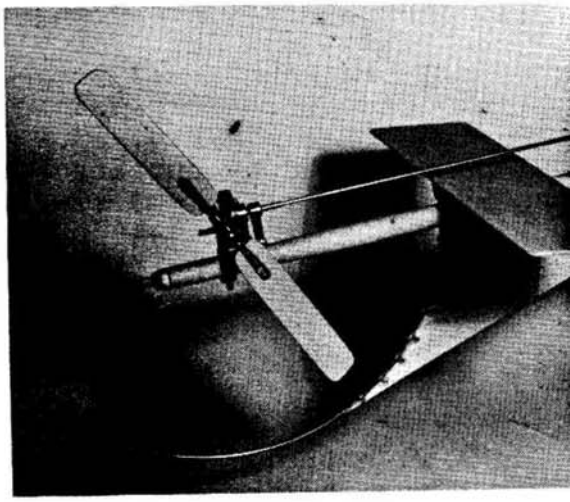
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MAIN ROTOR ASSEMBLY

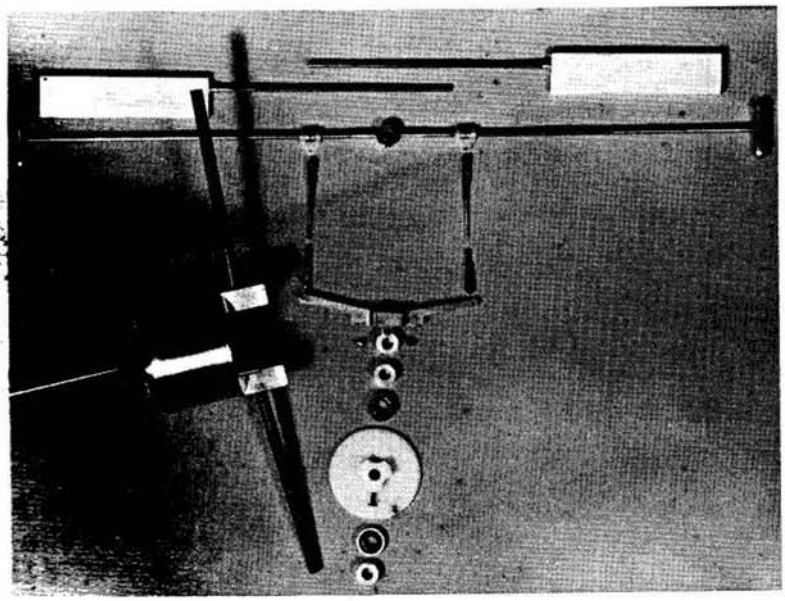
1. Assemble tank and main shaft. Screw main shaft all the way into top part of tank, slip the tank over the shaft and onto the top of the tank. Slip the brass nut with 1/4" hole in it over the shaft and down onto the tank. Using a large soldering iron or a torch, solder the nut to the main shaft. After shaft has cooled remove from tank and clean.

Slip the fiber washer on the shaft so it will be between the brass nut and the bottom of the tank. Screw the shaft into the tank and lock down tight.

2. Make the blade mounts using L-shaped 1/8" wire and the routed plywood parts. See Drawing D for part identification.

3. Fit the wire into the slots in the plywood. You may have to scrape out the slots a little, but the two blocks should not come completely together when you just press them with your fingers.

4. Use epoxy when gluing blocks together and clamp in a vise until dry. When clamping, make sure the plywood blocks come together. Be sure to get plenty of epoxy in the slots where the wire fits.



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5. After epoxy sets, clean any excess glue away from the edges of blocks. See Pix #20.

6. Find the center hub for the rotor and flybar. It has four holes. Two large holes go straight and two smaller holes go in on a 3 degree angle.

7. Slip the piece of brass tubing 1 1/2" long with a hole in the center of it, through the larger holes of the center hub. Line up the hole in the tubing with the center hole in the hub. This hole is where the motor control push rod will come through. Be sure to remove all burrs from tubing and brass parts.

8. Solder the tubing to the hub.

9. Solder the flybar weights on the ends of the two straight 1/8" wire rods.

10. Slip the nylon control horn and collar on the flybar rod and push out near the weight for now.

11. Slip the flybar rod into the brass tubing of the center hub. Push the rod in only until you can see it at the hole in the center.

12. Set center hub on a block of wood and set one flybar weight on a block of wood. This is to hold the weight straight in line with the hub as you solder the rod into the brass tubing.

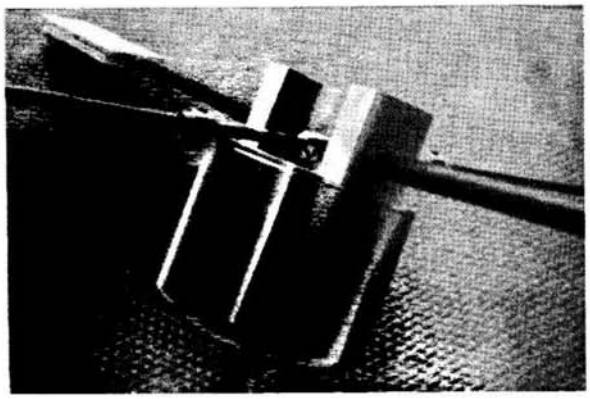
13. Solder the rod into the brass tubing and repeat 10, 11, 12, and 13 for the other flybar rod. See Pix #20.

14. Slip the blade mounts into the tubes on the hub through the brass bearings. Make sure the blade mount shafts turn freely.

15. Holding the flybar in the center of the tail between the motor mounts slide the blade mount shaft into the flybar. Be sure the flybar is right side up so that the holes in the flybar hub slant up and the blade mounting shafts will slip into the hub.

16. When the blade mounts are pushed in as far as they will go, check to see that the plywood mount is against the brass bearing in the end of the tubing. If not, remove the blade mounts and file off the end of the wires until the plywood blade mounts will rest on the brass bearing when pushed all the way in. If you file off the blade mount shaft be sure to file both blade mounts because the flybar must be in the center.

17. Holding the blade mounts into the flybar, move the nylon horn and collar on the flybar in until it just touches the side of the tank when the flybar is down against the top of the tank and lock in place with the set screw. See Pix #21.



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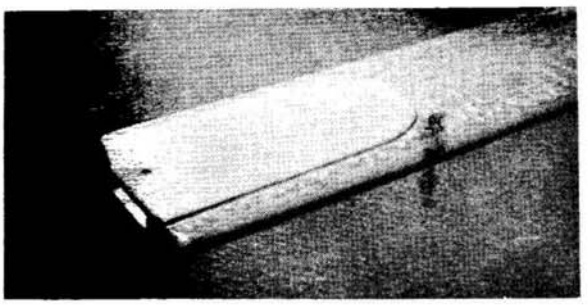
18. Make up main rotor blades by removing the balsa wood between the two slits in the end of the blades. Now cement (using white glue) the plywood doubler plates on either side of the blade. It is a good idea to lay the plywood plate in place on the blade and mark where the slot is so that when you are gluing the plate you do not get glue in this area. You should clamp the plywood plates to the blade as the glue dries. But don't clamp too hard and crush the balsa wood or you can't get the blade over the blade mount of the rotor hub. See Pix #22.



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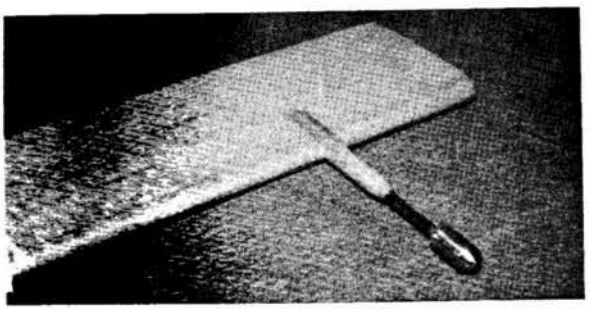
19. As the doubler plates are drying on the blades, make up the tip weights. Use epoxy to glue the 1/8" x 2" rods into the 1/4" dowell pins. Push the steel rods in all the way and be sure both are the same length. Now solder the brass weights on the ends of the rod.

20. Epoxy tip weights into the blades making sure they are in line with the blade. See Pix #23.



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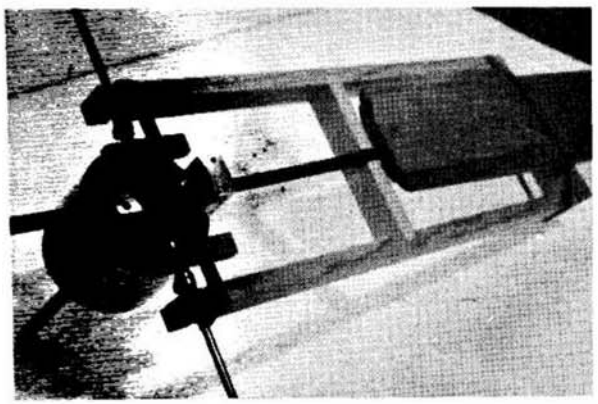
21. Sand the blade tips to shape and sand the entire blade smooth. But <u>do not</u> sand the blade edges too much and <u>do not</u> try to put an airfoil on the blades. Put three coats of clear dope on, then color. Don't overdo the paint on the blades.

22. Assemble the blade pitch gauge. Glue all parts together on a flat surface so that the gauge will be straight. See Drawing E for part location. Be sure that the angular piece of plywood which is the actual blade gauge is setting the right way.



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23. Mount the finished blades on the blade mounts on the rotor head. The rotor head will rotate clockwise as you look down on it. So mount the blades with the tip weights in front of the blade and the wider part of the blade mount should be toward the rear of the blade. With the blades in position on the rotor head, drill an 1/8" hole through the blade and the blade mount. Use a 4-40 bolt and nut to hold the blade in place.

24. Now you are ready to solder the blade mountings in place on the flybar hub. To do this use the gauge that you built in step 22. Slip the slotted ends over the flybar and hold down with a rubber band. Now slip the tubing holding the blade mount into slot in the gauge and bring the slanted plywood gauge up against the blade. Be sure the blade is facing the right way. The tip weight should be in front of the blade as the blade rotates clockwise.

25. Use a rubber band to hold the blade down on the gauge. See Pix #24.

26. Block the flybar with two small wedges between the flybar and tank to keep the flybar level with the tank top during soldering.
27. Check to be sure the blade mounts are in the flybar hub all the way and solder the blade mount to the hub. See Pix #25.
28. Put the gauge on the other side and repeat steps 24 - 27.
29. Prepare the flybar control arm by soldering the arms together, hold together with two Kwik-Links in the ends as you apply solder to the edges.
30. After soldering, clean edges with file and then file a slight bevel on the two edges which will slide on the swash plate. See Pix #26.

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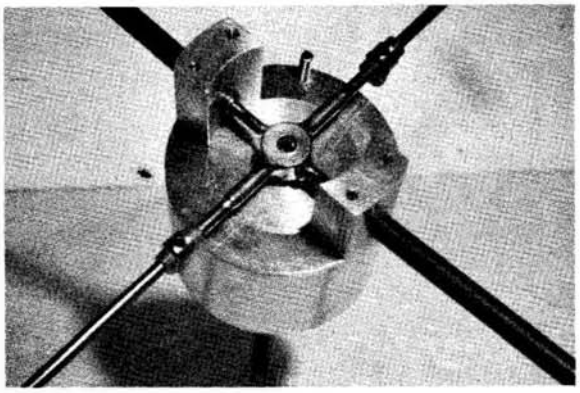
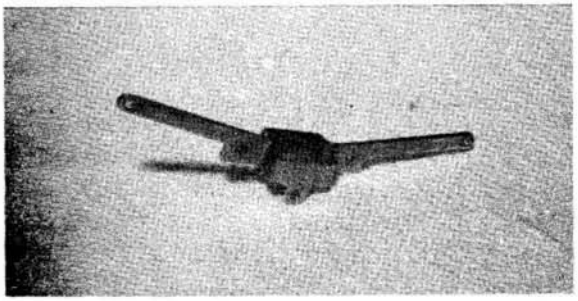


You may have to file the ends of the arm which ride over the swash plate in order to allow the arm to move inside of the middle ring on the swash plate. This can be checked after assembly of the swash plate. With the swash plate mounted and the control arm sitting on the swash plate from front to back, see if you can move the swash plate inner ring up and down. If you can and the control arm does not hit the middle ring, good. If the arm does hit the ring, the arm will have to be filed off to clear the ring.

26



31. Bend the arms to match the template Drawing F.
32. Mount the control arm on the brass collar which has two 4-40 holes and one 6-32 hole using two very short 4-40 bolts. The bolts should be screwed in only down to the control arm but not tight and solder the head of the bolt to the control arm. The arm should be free to move on the collar. See Pix #27.
33. Mount the control arm assembly on the main shaft so that the bottom of the collar is 7/8" below the bottom of the tank and the ends of the control arm are directly under the flybar and lock in place with set screw.
34. Make two control rods using the two Kwik-Links and two Solder Links and the two very short threaded rods. Solder the solder link on one end of threaded rod and screw the Kwik-Link on the other. Trim the threaded rod so that only the threaded portion of the rod is showing after being soldered into the solder link.
35. Install the two control rods between the flybar and the control arms. Adjust for equal length and movement. See Pix #28.

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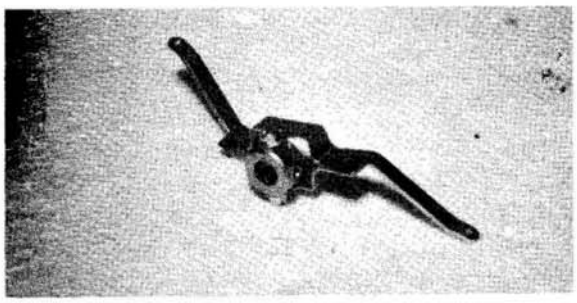

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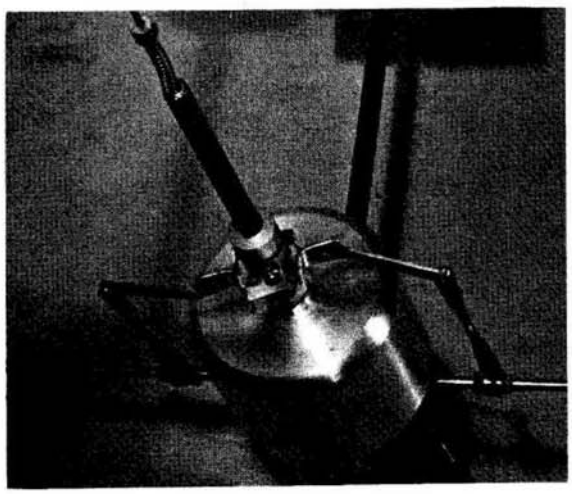

36. Assemble the swash plate rings by first trimming the ends of the pins on the inner and outer rings, just make sure that the pins are rounder on the ends and do not have any burrs on them. Set the inner and outer rings on one of the middle rings.

Check the location of the holes in the middle ring and position the inner ring properly. See Drawing G for proper alignment. Put the other middle ring on top of the bottom half of the middle ring. Again be sure the hole for the control arm is in the proper position. This is very important. Double check that the two holes for the control arms are in the proper position. See Drawing G and insert the brass eyelets and flare them with the tool provided.

37. Solder the small brass mounting onto the ends of the two control arms which will mount on the swash plate rings. Be sure to remove any burrs from wire and brass parts. Now press the arms into the holes in the rings in the position shown in Drawing H.

38. Mount the swash plate on the top of the wood frame with two 3/4" wood screws. Be sure the swash plate is in the center of the assembly.

39. Slide one of the large collars on the main shaft up to the top of the shaft, temporarily lock with set screw.

40. Slip main rotor head assembly into ball bearings in wood frame and slip it down until the flybar control arm just sits on the swash plate. Adjust the collar down on top of the ball bearing and lock down tight with set screw. The rotor head should now turn freely with the flybar control arm just riding on the swash plate. See Pix #29.

41. Using the 1/16" x 10" long wire provided, bend up the motor control push rod. Use Template to make bends. Drawing I.

42. Insert motor push rod through flybar hub and down through main shaft. Slip the spring over the push rod and hold in place with the collar and set screw. Adjust collar so top is 1 1/8" below bottom end of main shaft. See Pix #30.

43. Set the motor push rod so that it is on the opposite side of the tank from the fuel pick up tube which is in the tank.

44. To mount the motor mounting plate, it will be necessary to unscrew the main shaft and remove the tank. Now set the motor plate in place on top of the mount. (Be sure the motor push rod is in place.) Bolt to the motor mount with four 4-40 1 1/4" bolts. Put the nuts on the bottom. Reinstall the tank and the main shaft. See Pix #31.

45. With the motor mounting plate mounted on the rotor hub you can now mount the engine. Remove the four back plate bolts from the engine and set the engine on the mounting plate so that the fuel pick up tube in the tank is on the side of the engine with the needle valve, and using four remaining 1/2" allen head bolts, bolt the engine to the plate. See Pix #32.

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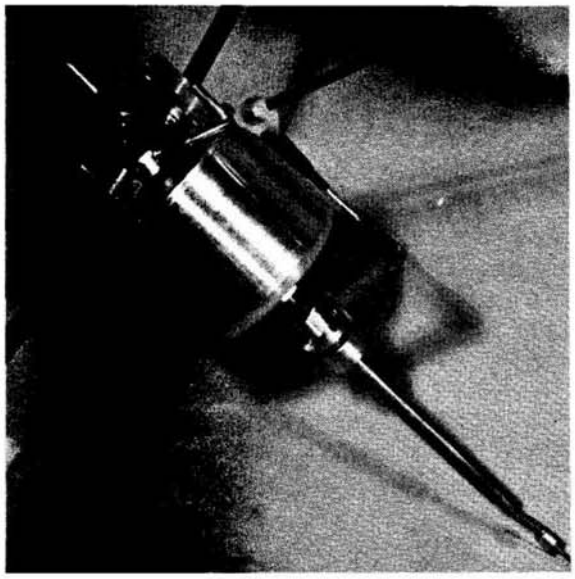

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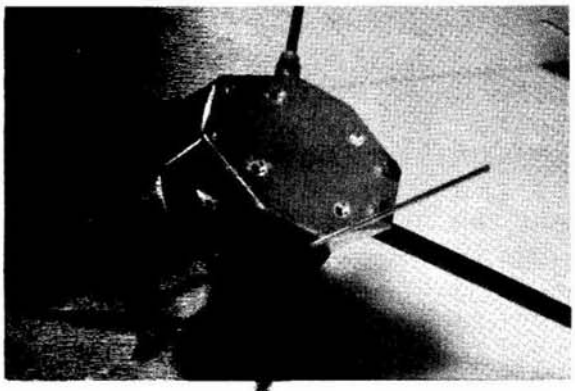

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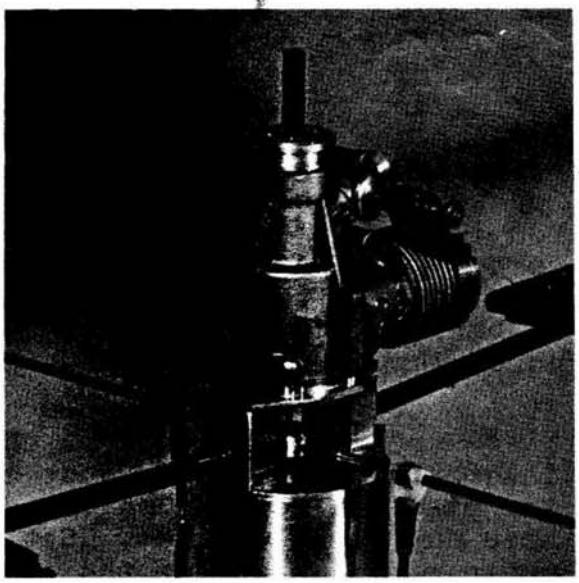
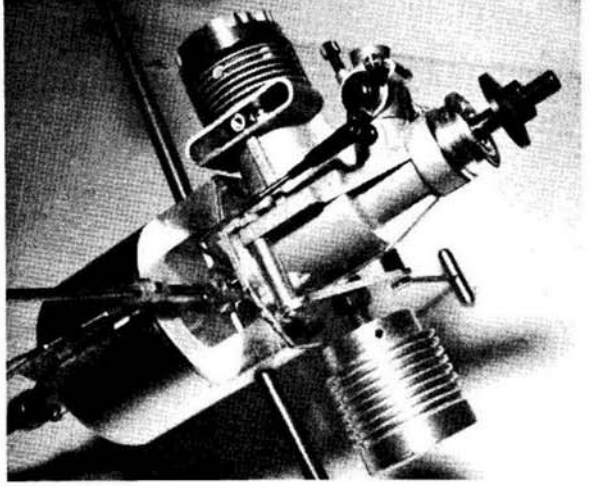


46. Solder the threaded coupler on the end of the throttle push rod and screw on a Kwik-Link. Adjust so that with the push rod down against the flybar hub, the engine is in low. This may need further adjustment after radio installation is complete. Check the push rod linkage by pushing up on the bottom end of the rod and see if the throttle on the engine opens and closes properly.



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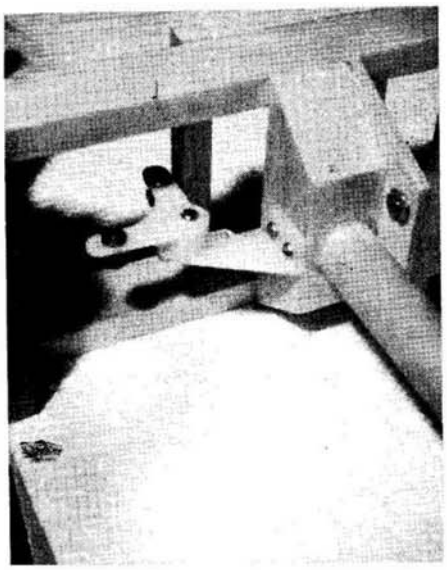
47. Make up the engine counter weight assembly by first putting the 1/4" 28 bolt through the center hole in the bracket and lock down with 1/4" 28 nut. You may want to round the ends of the bracket with a file. Mount bracket on engine beam mounts using the aluminum standoffs. You may have to tap or drill out the holes in the engine to accept the 6-32 bolts. Now screw on the large aluminum weight and install set screw. This weight will be adjusted later. See Pix #33. For final adjustment lock down with two set screws one on top of the other. This completes the rotor assembly. The balancing and adjustment of the rotor will be explained later under Adjustments and Set-Up.

34



35

CONTROLS

1. Make up throttle control bell crank, installing easy connectors and screwing to nylon mounting horn using the #2 x 5/8" sheet metal screw. See Pix #34. Note one easy connector has an eyelet mounted on it. This is for the push rod to the engine to ride in. This part is made up using the easy connector with a larger hole and slipping the flanged eyelet through the hole and carefully flaring the end of the eyelet so that it cannot come out.

2. Install the bell crank under the tail boom with two 1/2" sheet metal screws. Be sure the easy connector with the eyelet is in line with the motor control push rod in the main shaft. See Pix #35.

3. Install all servos. Drill holes for the mounting screws so you don't split the wood mounting rails. Put the fore and aft servo on the left side as you face the servo mounting (or looking toward the rear of the copter.) This servo is the elevator servo in your place. Install the side control or left and right main rotor control on the right side. This servo is aileron control in your plane. These servos must be set up so when you give forward control (or down elevator) the fore and aft servo moves the swash plate arm down, and when you give right control the side control servo moves the swash plate arm up. Install the motor control servo on the left side on the front servo mounting rails and the tail rotor servo on the right. The throttle must pull for high throttle. Tail rotor can be hooked either way. But, I prefer to move the control stick the way I want the tail to swing. This, of course, is backwards to the rudder control on your airplane, but I found it easier to control the tail this way. This would mean the servo will pull the cable when you move the stick to the right.

4. Hook up throttle control first. Mount an easy connector on the servo arm. Bend and install the 1/16" x 6" wire control rod to the bell crank. Check to see if you get full throttle when you move the stick to high motor. You will not need a very low idle. See Pix #36.

5. Hook up tail rotor control next. Start by inserting one end of the nylon tubing into the small hole in the tail boom mounting block. The other end of the tubing goes through the collar on the end of the long 4-40 bolt which also serves as one of the servo mounting bolts. Now solder the brass threaded rod with the hole in the end onto the end of the .020 wire and thread a Kwik-Link on the brass rod. Use a Kwik-Link with no pin. Now snap this Kwik-Link on the brass coupling on the tail rotor control arm. Slip the control cable through the guide on the side of the tail boom and through the nylon tubing in the tail boom block. Now mount a easy connector on the servo arm. Use the hole in the arm closest to the center of the arm. Solder the 3/4" piece of 1/16" brass tubing on the control cable where it will go through the easy connector and trim off control cable. Slip cable into easy connector and adjust tail rotor so blades are straight or in neutral when servo is in center. Check to see if when you give left and right control the tail rotor blade changed pitch. See Pix #36.

6. Make push rods for fore and aft control. This is a spring loaded push rod and the rod should slide free in the solder link. The spring should be soldered onto the rod on one end and onto the solder link on the other end. You should have about 1/4" of rod showing through the solder link with the spring at rest. See Pix #37 and #38.

7. Make and install the push rod for side control the same as you did in Step 6. See Pix #36.

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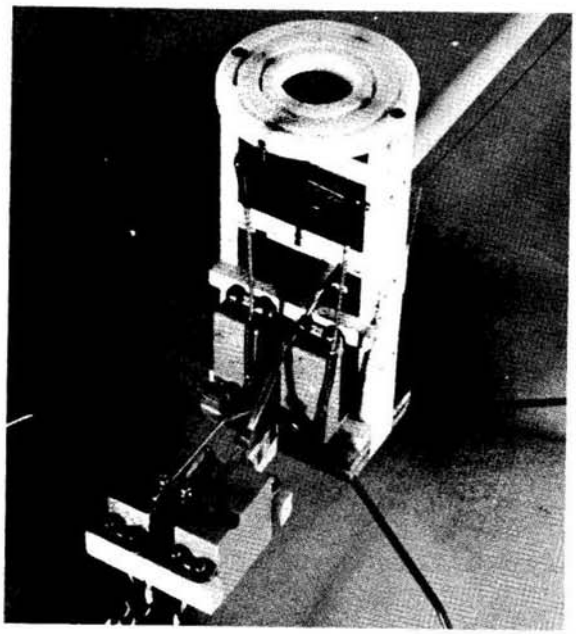

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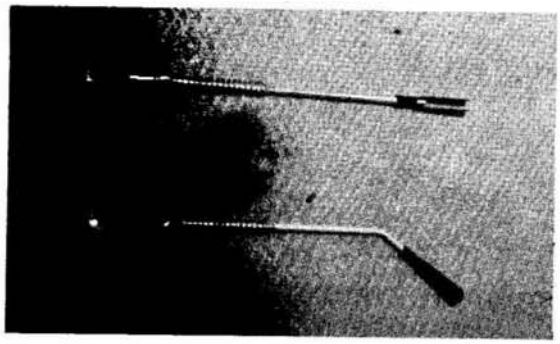

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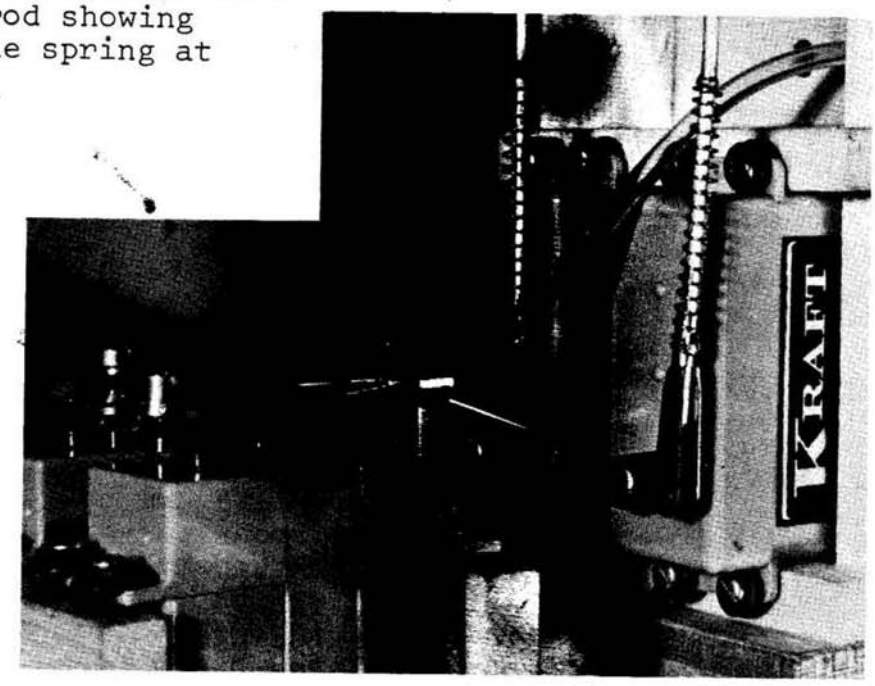

ROTOR AND BODY INSTALLATION

1. Before installing rotor head, see Adjustment and Set-Up Instructions. To install rotor assembly, set large nylon gear on bearing block over hole for main shaft. Have the collar which will go on the bottom end of the main shaft ready with the set screw in it. Now carefully slip the

main shaft down through the top ball bearing, through the large nylon gear, and start into the bottom ball bearing. At this time, hold the collar in place under the lower ball bearing and slip the main shaft through the collar. See that the throttle push rod is going into the eyelet on the bell crank. If everything is lined up, push the shaft all the way down. Then slide the large collar up the shaft until it hits the ball bearing and lock it in place on the flat spot on the shaft with the set screw.

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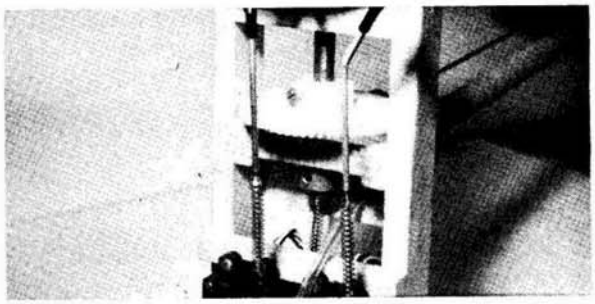

2. Set the large nylon gear in place on the shaft for a good gear mesh. Not too tight, and lock in place with the screw against the flat spot on the shaft. Check to see if when you rotate the main rotor the tail rotor rotates. It should and without any binding. See Pix #39.

3. Assemble the plastic body shell next. Start with the lower rear shell because this is the easiest to do. Put the right and left half together. Check alignment then clamp together. Using the clear welding cement and a small paint brush or an inking pen, put a small amount of cement on the seam on the inside of the shell. Very little cement is needed. Let the cement dry about 10 minutes and using the thick white filler cement in the plastic squeeze bottle, apply a bead of filler to the seam on the inside of the shell. This should set about one hour before fitting the shell to the copter.

4. Fit the right and left half of the front shell together and hold together with masking tape in several places and apply the welding cement to the seam with the brush or inking pen. Don't use too much cement. It takes very little to make a good joint. If you get too much cement on the plastic it will distort the seam. After the cement has set for about 10 minutes, remove the tape and go over the seam again with the welding cement. When the second coat has set about 30 minutes, apply a bead of the filler to the seam and allow to dry about one hour before fitting to the copter.

5. Install the bottom body shell first. Trim to fit around landing gear. Now fit front shell. Trim bottom to fit over bottom shell and around landing gear. Install radio batteries in nose and then receiver. Cut hole and mount switch. A good place for the switch if you have room is on the bottom of the front shell just in front of the servos. Antenna will go back into the tail boom. Cut holes for swash plate controls to go through. Make holes as small as possible, but be sure that the push rods do not rub the side of the hole at any control position. Slip front shell in place and hold in place with three 1/2" sheet metal screws (with washers) at each side of body. See Pix #40.

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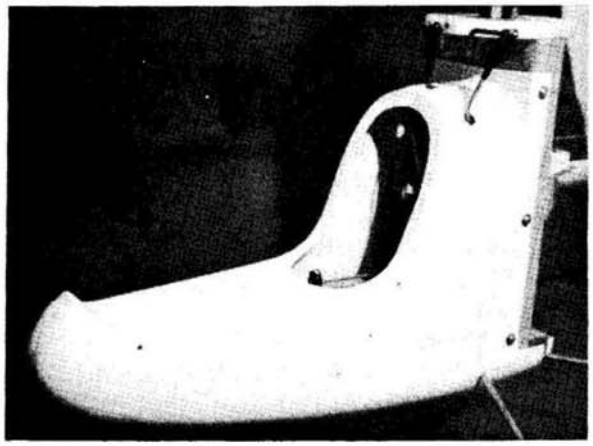
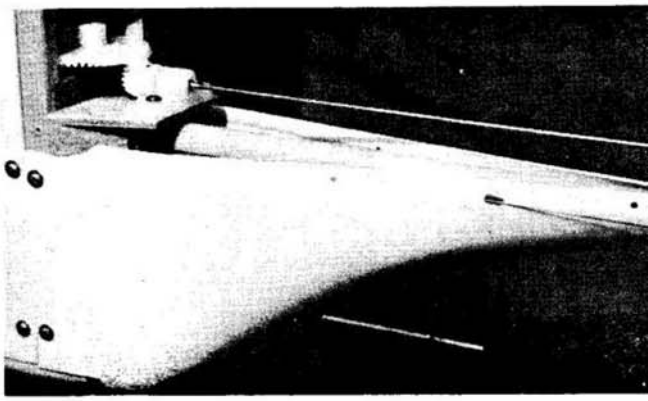


6. Trim lower rear half of body to fit around landing gear and fit against front body shell. Mount this shell with two 1/2" sheet metal screws on each side of body. See Pix #41.
7. Trim top rear half of body and drill hole for tail rotor drive shaft to go through. The drive shaft will have to be removed from the copter and inserted through the body shell. Mount the shell to the frame with two 1/2" sheet metal screws on each side and put two 1/2" sheet metal screws through the top shell, the bottom shell, and into the tail boom at the rear of the body. See Pix #42.
8. Trim and fit canopy and hold in place with four 1/2" sheet metal screws. See Pix #43.
9. You can add trim to the body if you wish. Then you are ready to adjust and set it up for flight. For trim design, see Drawing L.



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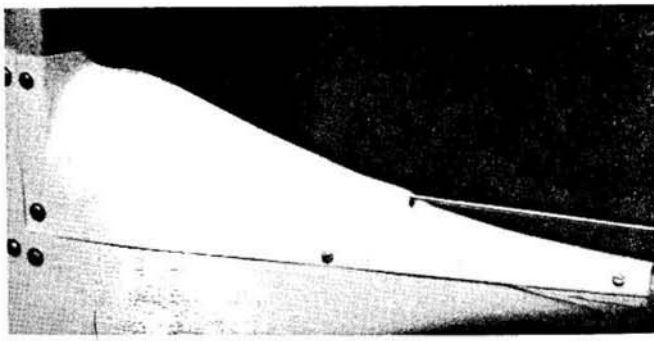

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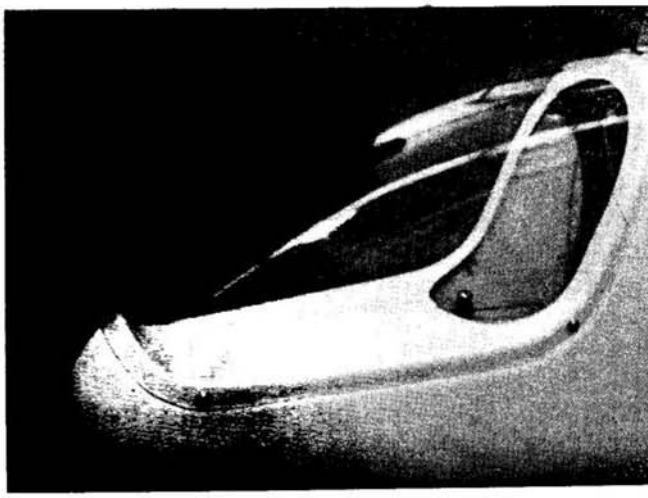
ADJUSTMENT AND SET-UP

Main Rotor



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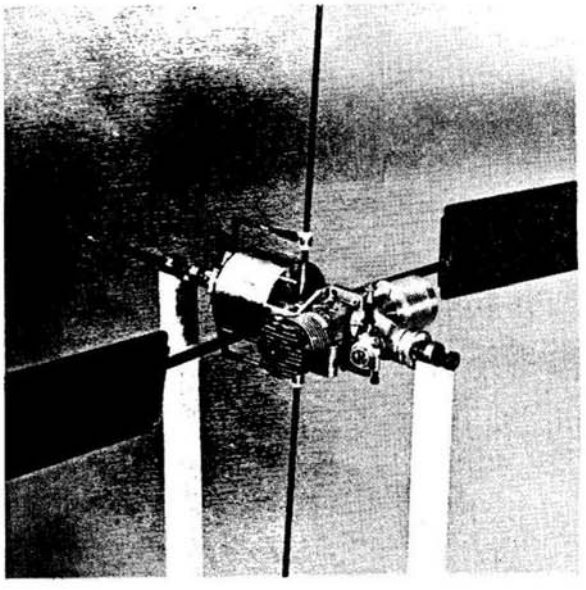
1. Before installing main rotor in copter, it must be balanced. You can do this two ways. The first way is the easiest, but not the best. Set the complete rotor head assembly into the bearings in the copter. Do not use the large nylon gear and do not push the rotor all the way down so the flybar control arm hits the swash plate. Lay the copter on its side on the edge of the table and balance the rotor as described in the following balancing method. The best way to balance the rotor is to first build the balance stand shown in Drawing K. Now using the ball bearings from the copter, put one bearing on the main shaft and the other on the engine shaft. Set the rotor assembly on the stand on the bearings. See Pix #44. Now turn the rotor so the blades are parallel with the floor and see which blade is heavy. If the blade on the side with the engine cylinder is heavy, screw the counter weight out until the blades will balance. If you cannot screw the weight out far enough to balance the blades, try reversing the blades. Put the heavy blade on the other side, then screw the counter weight in. If this still won't balance the blades, you will have to add some paint to the light blade. Make sure paint is dry before trying to balance again. Now that



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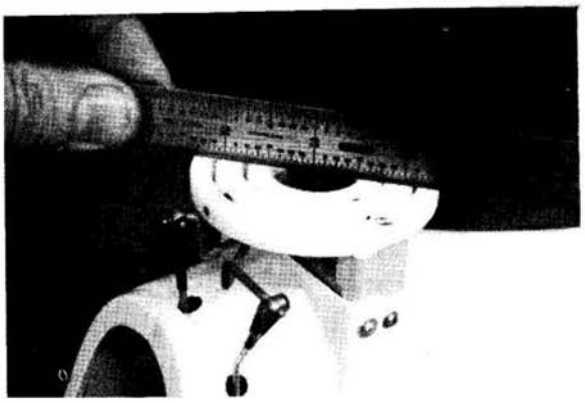
you have the blades balanced that way, lock the counter weight with two set screws, one on top of the other to act as a lock. Then turn blades so they are vertical and check the balance. The blades should be very close to balancing. If so, good. If not, you may have too much solder on one side of the flybar. After balancing, and before installing rotor in copter, adjust the swash plate. Do this by adjusting the control push rods until the plate is level. Lay a small steel ruler across the plate to see if it is level. When the plate is level, you can install the rotor head. See Pix #45.



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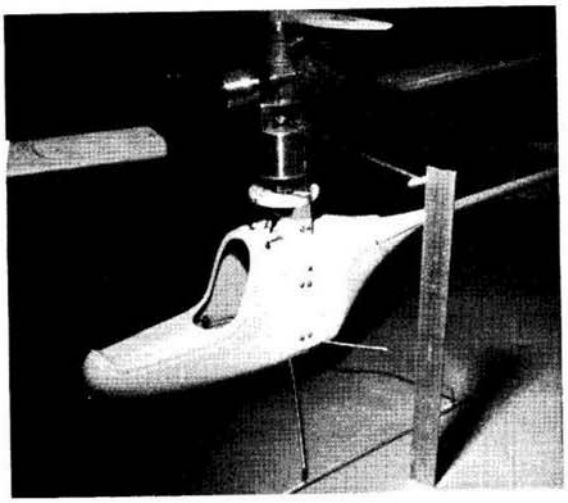
2. Adjust the flybar push rods now by setting the copter on a flat surface and with the flybar setting across the copter from side to side measure up from the table to the flybar weight. Each side should be the same within 1/8". If the flybar is off more than this, remove one of the push rods to the flybar and lengthen or shorten the other one until the flybar is level. Then re-install the other push rod. See Pix #46. Be sure that when making this adjustment the swash plate is level.



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3. The push rods going to the swash plate from the servos should be in the farthest hole from the center of the arm on the servo to give proper control movement, or about 1/2" from the center of the control arm on the servo to the hole for the Kwik-Link on the push rod.

Throttle Control

1. Check throttle push rod setting. With the control stick set for high throttle and full high trim, the push rod should just hit the bottom of the engine mounting plate and the throttle should be wide open. With the control stick set for low throttle and the trim control full back, the push rod should just hit the top of the flybar hub. Adjust the linkage until you get this condition.

Tail Rotor

1. Tail rotor should be adjusted until the blades are in a neutral condition (no pitch) when the control stick and the trim are in neutral. Neutral tail rotor control will then have to be adjusted with the trim control when the copter is in the air. You will probably have to move the trim for a little left rudder. (Tail rotor)

Balance

1. Install a 10 - 6 prop (preferably wood). You must use a 10 - 6 prop for proper performance. A standard Top Flite prop is best.
2. With the copter setting on a flat surface, lift the copter up by the prop shaft of the engine. If properly balanced, it should lift straight up. If it tilts slightly forward, that is alright. But you do not want it to tilt backwards. Add weight to the nose or move the battery if it tilts back.

3. Now that the copter is completely finished and ready to fly, weigh it on a good scale. It will probably weigh about 3 lb. 8 oz. If so, add lead in the bottom shell of the body until the copter weight is 3 lb. 14 oz. This is a must. If it weighs more than this, it may not lift properly, and it it weighs less, it will not have good control or stability. It has been found that for flight practices, you can add weight to the copter until it will only lift about one foot off the ground with full throttle. This will allow you to practic without getting too high.

ADJUSTMENT AFTER CRASH

This section will explain how to re-adjust and what to check after a crash. We will consider a very bad crash and then you can use the parts of the instructions which fit your repair job.

Main Frame

1. Check all joints and re-glue if necessary. Remove landing gear and straighten legs. If skids are broken, replace with new ones.

Tail Rotor

1. Broken blades can be replaced by unscrewing the blade from the hub cutting off the epoxy glue and installing a new blade.
2. Check to see if the blades are bend and straighten if they are.
3. Check gear mesh. Make sure blade turns freely.

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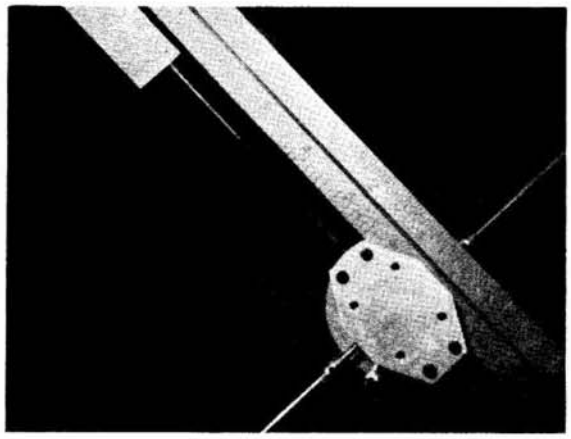
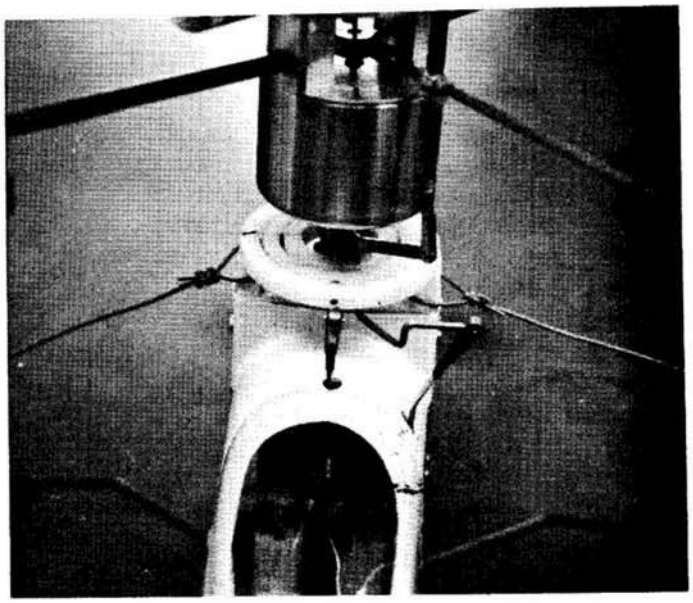


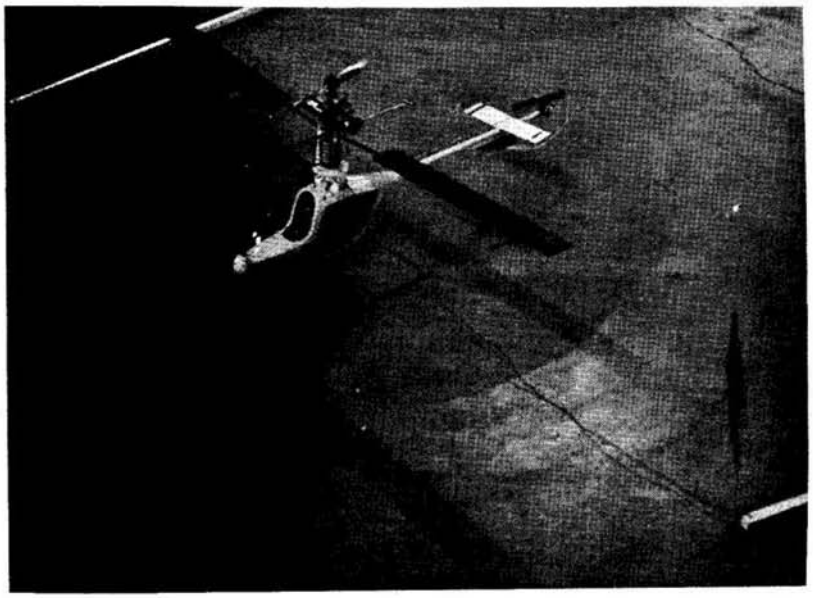
Main Rotor

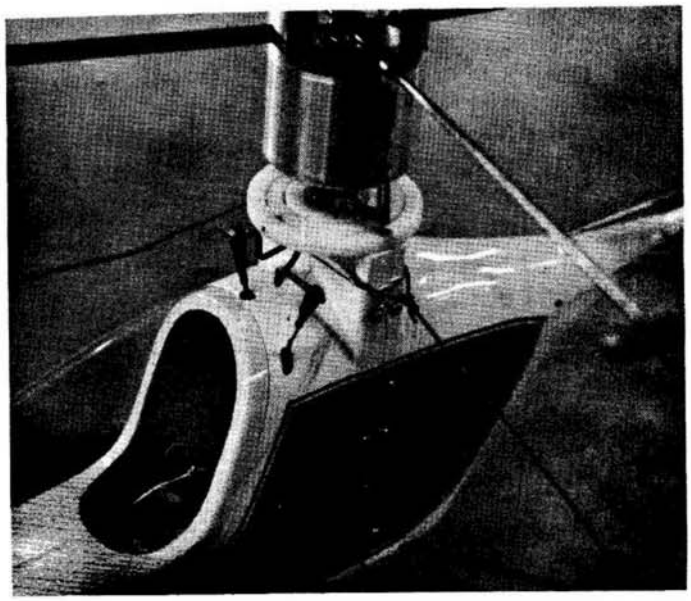
1. Straighten all bent tubing and wire rods. Make sure flybar is straight. Check the blade mounting arms (1/4" steel tubing). Use a straight edge to see if they are square. You can also use the blade pitch gauge by slipping the gauge on the flybar and then adjust the tubing so that it will fit into the slot without forcing it. See Pix #47. If main shaft is bent, straighten it as best you can for now. We will check it later.
2. If blades cannot be epoxied together, they will have to be replaced.
3. Check and adjust the blades first. Check the pitch angle with gauge. If the pitch is not right, re-solder the joint at the flybar hub and re-set the blade angle. With the blade gauge in place, check to see if the blades are swept forward properly. Do this by laying a straight edge along side of the gauge in front of the blade and the leading edge of the blade should meet the straight edge at the point where the tip weight is mounted.
4. To adjust a bent main shaft, you will need to build a simple gauge. See Drawing **J**. Now remove the blades and set the rotor assembly into the bearings of the copter. Set the copter on a flat table. Set the pointer of the gauge over the center of the engine shaft, and slowly rotate the rotor. You can see if the shaft is bent and if so which way to bend it to straighten it.
5. When the shaft is straight, check the blade mounting tubes (1/4" steel tubes) with the gauge by setting the pointer at the tip of one of the tubes near the plywood blade mount. And then rotate the rotor carefully and see if the other blade tube is the same. The pointer should come the same distance from each tube as it passes the gauge.
6. Install the blades and check the tips of the blades in the same manner with the gauge.

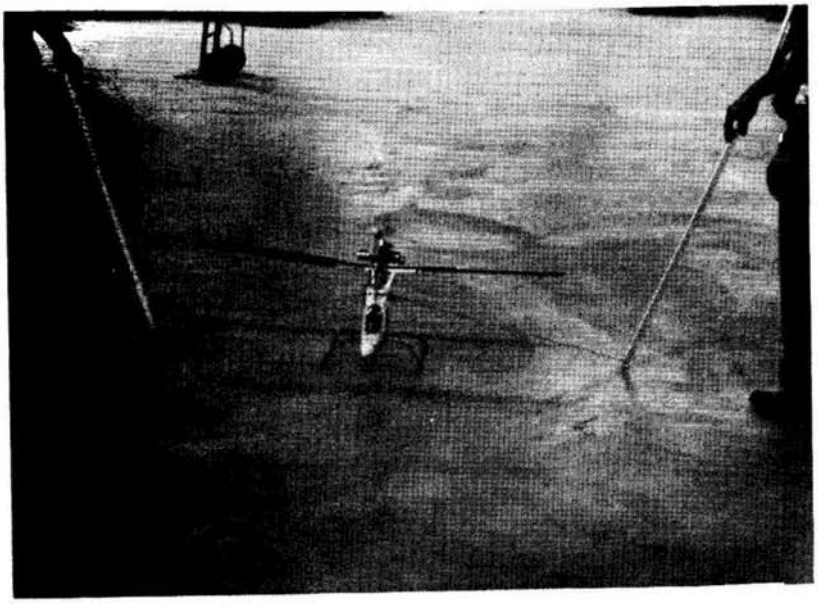
7. Now that everything is straight again, go back through the adjustment and set-up steps again and you will be ready to fly again. If you had to replace or repair the blades, you will have to re-balance the rotor.

All parts are replaceable and available. See parts list for price and part number.









FLYING AND FLIGHT TRI

When you are ready for the first flight, we suggest the training method shown in the pictures. With two people to help you, you should be able to get off the ground without breaking anything.

First of all you should understand a little about flying a helicopter. You will not learn how to fly it overnight. It takes alot of practice and patience. There is no such thing as an expert. With a helicopter, everyone is a beginner. Even if you have been flying airplanes for years, you are a beginner when it comes to flying a copter. You should spend about two hours flying the copter on the training wires before you attempt free flight. At this point you should be able to fly with the lines slack for 30 to 40 seconds at a time.

Now to get started. First get the training lines hooked up and two people to help you. Fuel up and start the engine. Hold the rotor blade during engine starting and throttle adjustment. With the engine in low throttle, let the rotor go. (Don't forget to turn the radio on.) Stand behind the copter and prepare yourself for your first helicopter "flight".

Before you lift off, we should say more about the people holding the lines for you. You should give them a little training first so they know what to do and what to expect when the copter lifts off the ground. First and most important is for them to keep the end of the stick which has the line on it on the ground at all times. If they lift it up they may catch the line in the rotor blade. On your first flights they should not let you get more than 12 to 18 inches off the ground. You should also put a wire between the skids both front and rear. This is to keep the lines from getting hooked on the skids which would cause the copter to tip over. The lines should be only 3 to 4 feet long, longer lines will get hooked on the rotor too easily. You can also tie the lines to the floor or ground and not use the wood sticks with two people holding them. If you choose to use this method, the lines should be adjusted so you can only lift about 12 to 18 inches. The advantage of the two people using the sticks is that you can move around and fly with slack lines for a longer time. Now you should be ready to lift off for the first time.

You first have to check and adjust the trim controls. Do this by advancing the throttle slowly until the copter lifts. It should lift straight up. The copter must be off the ground in order to be controlled as long as the copter or any part of it touches the ground. You cannot control it. (Do not give any other control but

throttle.) If the tail boom swings either left or right, cut the throttle and adjust the trim until the tail stays straight when you lift off. Also, if the copter moves forward every time you try to lift off, move the fore-aft trim control back slightly. The same for side control. Not much trim control is necessary to make a difference. Now that you feel that the trims are set, lift off and using only the tail rotor control, try to keep the copter pointing in the same direction. The tail rotor control is the hardest control to learn, and you must be able to control the tail before you can use the other controls with any accuracy. If, after a few tries, you seem to always give the wrong tail control or the control feels backwards, reverse the servo and don't try to fight it. All early flying should be done not more than two feet off the ground, so watch the throttle. Before you are ready to fly free you must be able to control all four controls at the same time and in coordination with each other. Now if you are able to hold the tail a little bit try the main controls. If the copter tilts and moves forward, move the control back to straighten up, the same for left and right control. At first you will probably over control and the copter will go in the opposite direction. You will just have to practice and get the feel of it. When starting out just try to hover or keep over the same spot. Do not try to move forward or in any direction. That comes later. For right now just keep practicing.

Let us assume that you can keep the copter in the air and somewhat over a spot without any help from the two people on the lines for 40 seconds to one minute. You can now take off the lines and try some free flying. We should mention that up to now, and for sometime to come, you should fly the copter when there is no wind or inside if possible. The wind just makes flying that much harder and you have enough to do right now without fighting the wind too.

At first when flying free, just try to hover over one spot. This is very good practice. You should keep flying like this until you can fly out a tank of fuel without touching the ground (or anything else).

When you can hover or generally stay over or near one spot for an entire tank of fuel, which is about 6 to 8 minutes, you are ready to try some forward flight. Again, let me say you should be doing all your flying at less than 3 or 4 feet altitude. When starting to make forward flight do so very slowly. Just bump the stick a little until the copter starts to move forward, then watch to see that it does not move too fast. The moving of the main control stick will control the speed of the copter, not the throttle as on an airplane. As you go into forward flight you will run into your next problem. As the copter moves forward (or in any direction) it will tend to

roll to the left. This is due to the air moving past the blades and making the advancing blade lift more than the retreating blade. So you must give a little right control as you move forward. The faster you move through the air, the more right control you must give to keep the copter from rolling to the left. This is the same no matter which direction you are going. If you are moving left you will have to give forward control to keep from rolling backward, or if you are backing up you will have to give left control to keep from rolling to the right, and so on.

As you get the feel of forward flight, let's try a few simple turns. When you are flying as you are now or down low and moving very slow forward, all turns must be made with the tail rotor control. So move forward and at the same time give a little left tail rotor and the copter should swing around to the left. Sounds easy, doesn't it? Well, keep practicing and soon you will be able to fly back and forth in front of you or stop and hover at will. It is still not a good idea to fly more than 4 or 5 feet up. Up to this altitude if you get in trouble you can just cut the power and drop down without hurting anything. Above that altitude you must fly it back down or crash. And speaking of flying back down, it is about time to start working on landing because you are getting ready to climb higher. As you will find out, going up is easy, but coming down seperates the men from the boys. This maneuver is one which you will have to work into very slowly and get the feel of it. I will try to explain as best I can and then it is up to you. There are three ways to get back down after you have gotten up there. One is to let down slowly over a spot more or less straight down. The second is to fly down by moving forward and descending which is by far the hardest, but the right way. And the third way is to crash, which is the easiest way but the hardest on the copter. To start with, use the first method and try not to use the third.

OK. Here we go. Assume you are 10 feet in the air. For heavens sake don't start that high, but use the same procedure and work up. Hold the copter in a hover and very carefully back off on the throttle watching very closely for the copter to start descending. As soon as it starts to come down advance the throttle a little, not too much or you will go back up. Just enough to slow down the descent. Let me explain what happens when you start down. First you back off on the throttle, the engine slows down and the main rotor then turns slower. This is where the problem is. If you let the rotor slow down too much you will lose control because the blade is not stable anymore. So as the copter starts down you know the power is low enough to come down. Now you must keep the rotor turning as fast as you can without going back up. Also, as the copter moves down, more air is moving up through the blades and this tends to

slow the rotor even more so. Never try to come down fast. Practice this maneuver in gradual steps going a little higher as you improve. I should say that if you should be up 10 or 15 feet and start down too fast and you think you are losing control, open the throttle all the way and climb back up. If you caught it in time you can save it and try again.

Before I explain the second way of landing, we should cover another problem of helicopter flying. This problem comes now that you are flying higher (10 to 15 feet) and moving faster forward. The problem is falling out of the air or tipping over and coming down upside down. Sounds messy. It is, but the copter will normally come out with only broken blades and bent shafts. Anyway back to the problem. If you move too fast forward for the amount of throttle setting, the copter will fall out of the air. Once it starts to go you might as well cut the throttle and watch it crash, because it is going to crash and you cannot stop it. So watch your forward speed. This copter is capable of moving forward about 25 m.p.h. with full power, but as you back off on power you must slow down.

Now maybe you will appreciate the difficulty of the second landing method. To land or come down as you're moving forward is difficult but very satisfying to be able to do so. To start with let us say you are up 15 to 20 feet. You should be able to set up a descent that would put you on the ground safely in about 100 feet of forward motion. This will give you some idea of how steep to come down. OK. Here we go. You are up 20 feet and moving forward. Keep the same forward speed and very carefully back off on the power and watch for the descent to start as before. But this time you should not need to put power back on unless of course you slowed down too much, in which case you probably tipped over and crashed anyway. So just watch the descend to see that it is not too steep. Now for another problem. As you are coming down this way try not to make any turns or if you must, make very gentle turns preferably with the tail rotor because if you make a banked turn (a banked turn is a turn where you are moving forward fast enough to just move the control stick left or right and the tail will follow and come around like an airplane) and make it too tight the copter will fall off to the side the same as it will if you are going too fast forward. Assuming you are coming in alright, as the copter nears the ground pull back on the forward control to slow the forward speed and at the same time put on power to slow the descend. When you are good, the copter will stop in a hover about one foot from the ground and then you can let down to a soft landing.

As you can see, the greatest problem in flying higher and faster is to watch the speed in relation to the power. This

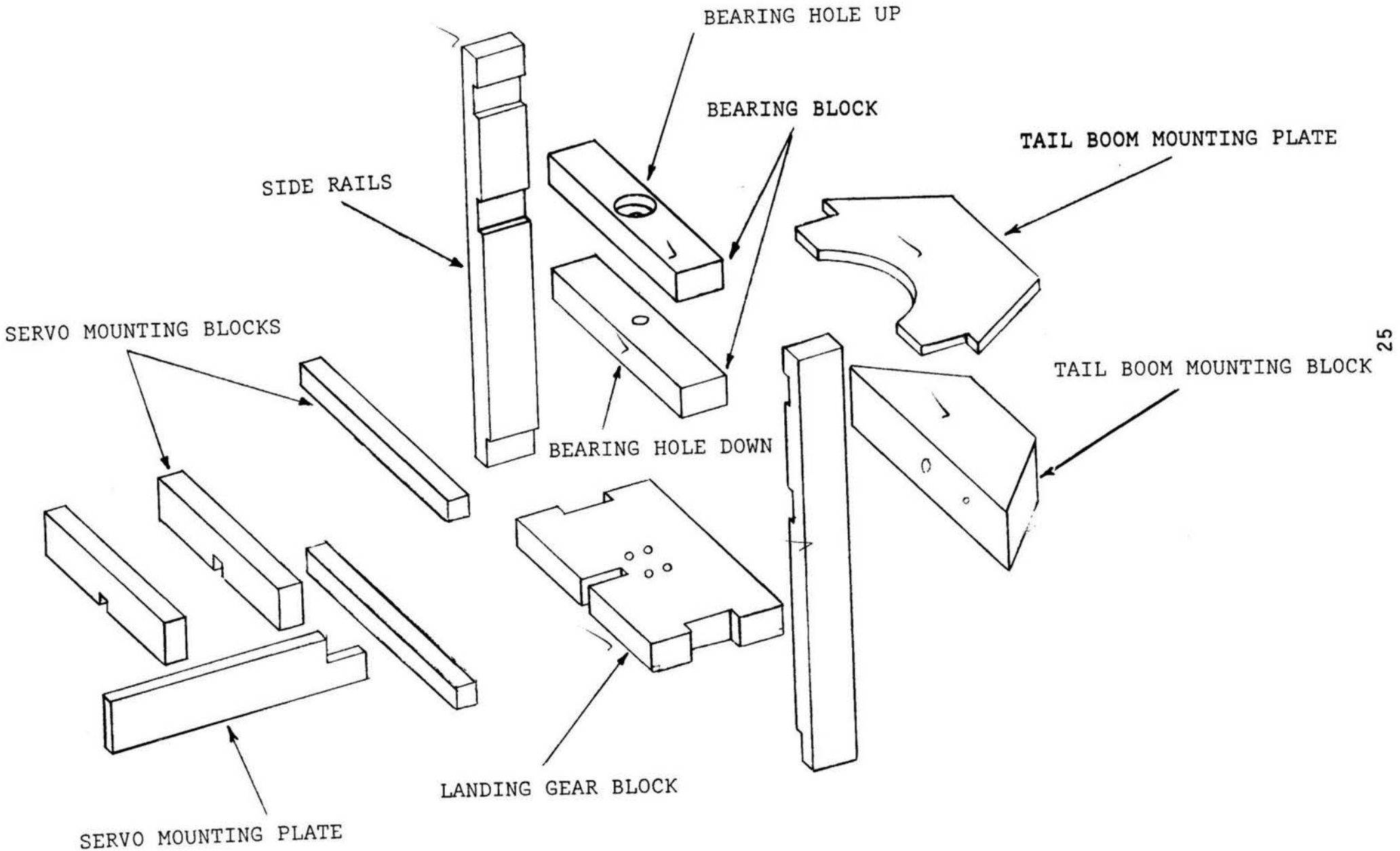
problem is the same on full sized copters only you are sitting in the seat and watching gauges to tell you when you are getting close to trouble. With the model, you must see the problem and by then it is too late to correct. When you have gotten this far it is time to start flying in more wind. As everything else in flying the copter, do this in slow steps. You will find the wind is like another control. It is there and it isn't. If it is a steady wind it is better because it is always there. When flying in the wind you are using your controls alot more than in calm weather. For instance, as you are moving up wind you need less power to keep from climbing, and going down wind you need more power to keep from settling. At the same time your forward speed must be less going up wind because of the lower power. You can tip over easily. Remember your forward speed is airspeed not ground speed we are talking about, and if the wind is blowing 10 m.p.h. you are going 10 m.p.h. in a hover. Speaking of hovering in the wind, you must use corrective side control when facing into the wind. For instance, if you are facing into a 10 m.p.h. wind and are hovering you must give right control the same as you would if you were moving forward at 10 m.p.h. The same is true if you are hovering with the wind coming from the left, you must give forward control to keep from rolling backward. Also the tail rotor is much harder to control in the wind. For instance, if you are hovering and facing into the wind you are holding forward control to stay over one spot. You are giving right control to keep from rolling left and now if you wish to turn say right, you move the control to the right and the tail swings into the wind. It takes more and more control to bring it around into the wind until the body is directly cross wind. Now the wind is coming from the left side of the copter. At this point (if you haven't lost it already) you are holding left stick to stay over the spot and forward stick to keep from rolling backward and alot of right tail rotor control. Now continuing the turn you will use less tail rotor control as the tail comes around into the wind. At the point where the tail is directly into the wind the controls have again changed. Now you are holding back control to stay over the spot and left control to keep from rolling to the right. Also the tail rotor is at its most difficult position to hold because if it moves either left or right and the wind catches it, it will swing around very fast unless you catch it. Now this same condition follows the copter whatever you are doing in the wind, whether you are hovering or moving forward. Whenever you make a turn the same things happen I just described and the stronger the wind is the more pronounced the problem is. Also you can see what would happen if it was gusty. It takes alot of practice and time but it can be done. The helicopter is capable of flying in the wind. Is the pilot?

Now for a few other little tips of flying that I have learned. When starting out it is best to take off from a hard surface. When you become more proficient at flying you can take off from the grass. But the take off is done a little differently. You increase the throttle until the copter gets light and the rotor is turning at a good speed. Now open the throttle and get off the ground and out of the grass quick. This also brings up another thing. Do not give control on the main rotor until it is turning at almost take off speed. If you move the controls at too low a rotor speed you will get a violent reaction and may tip the copter over. Another thing to watch for is when you are flying out away from you and the copter is 100 feet or more from you, you should not go into a hover because it is very hard to tell which way the copter is facing and what it is doing so you can't tell what controls to give it to keep it upright. If you should find yourself in this situation, push the stick forward and start moving so you can tell which way is forward. And again this has to do with the tip over problem. When making turns during forward flight watch the bank of the turn and do not get it too steep without enough power. It is best to use some tail rotor control and make a flatter turn. If you are under full power and climbing out you can make quite a steep banking turn but the less power you are using the flatter the turn should be.

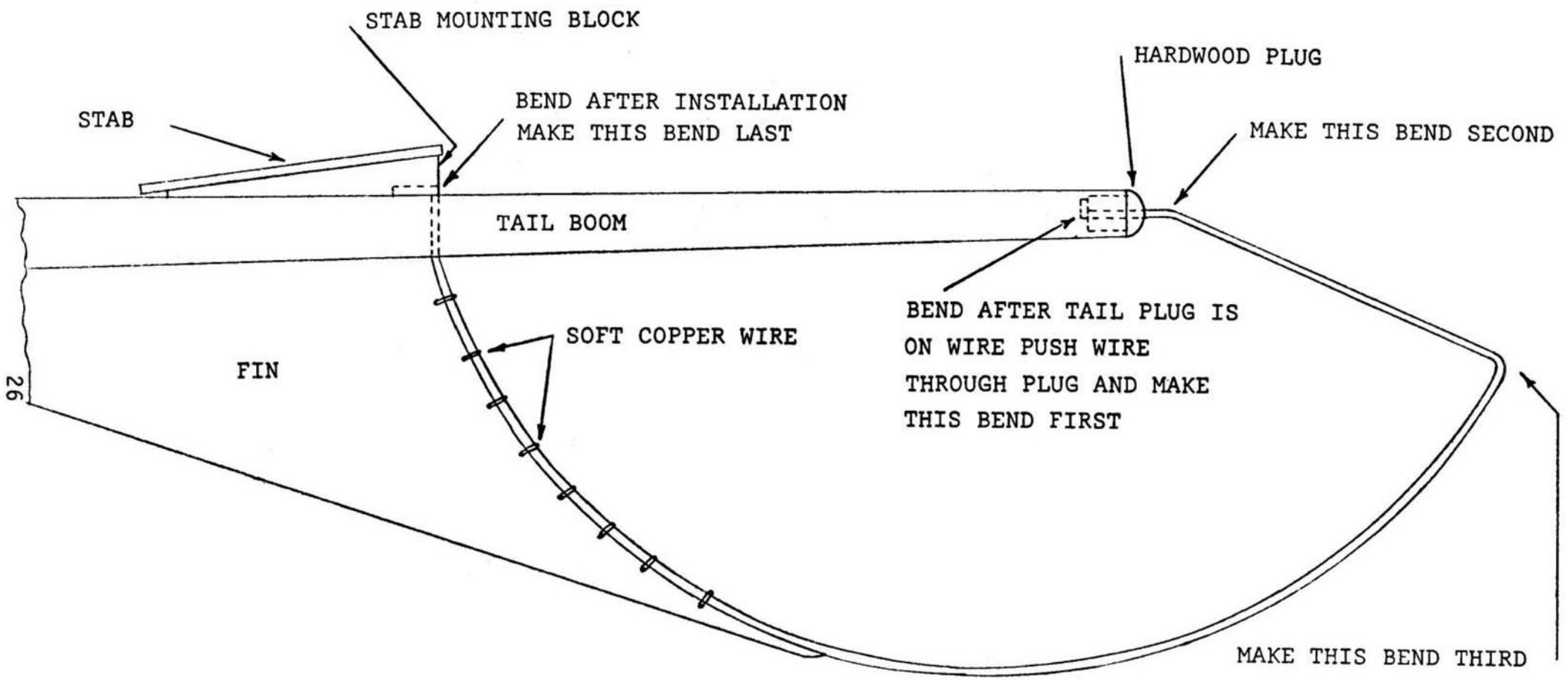
Well, that's about as far as I can take you at this time because like everybody else, I am still learning the problems of helicopter flying. But now maybe we can start learning together and someday we will be flying RC helicopters as easy as we are now flying airplanes. You know it wasn't too many years ago that it was a real accomplishment to just fly around the field and land in one piece with an airplane. So who knows what the next few years will bring in helicopter flying and designing.

Good luck and let us hear from you.

DRAWING A

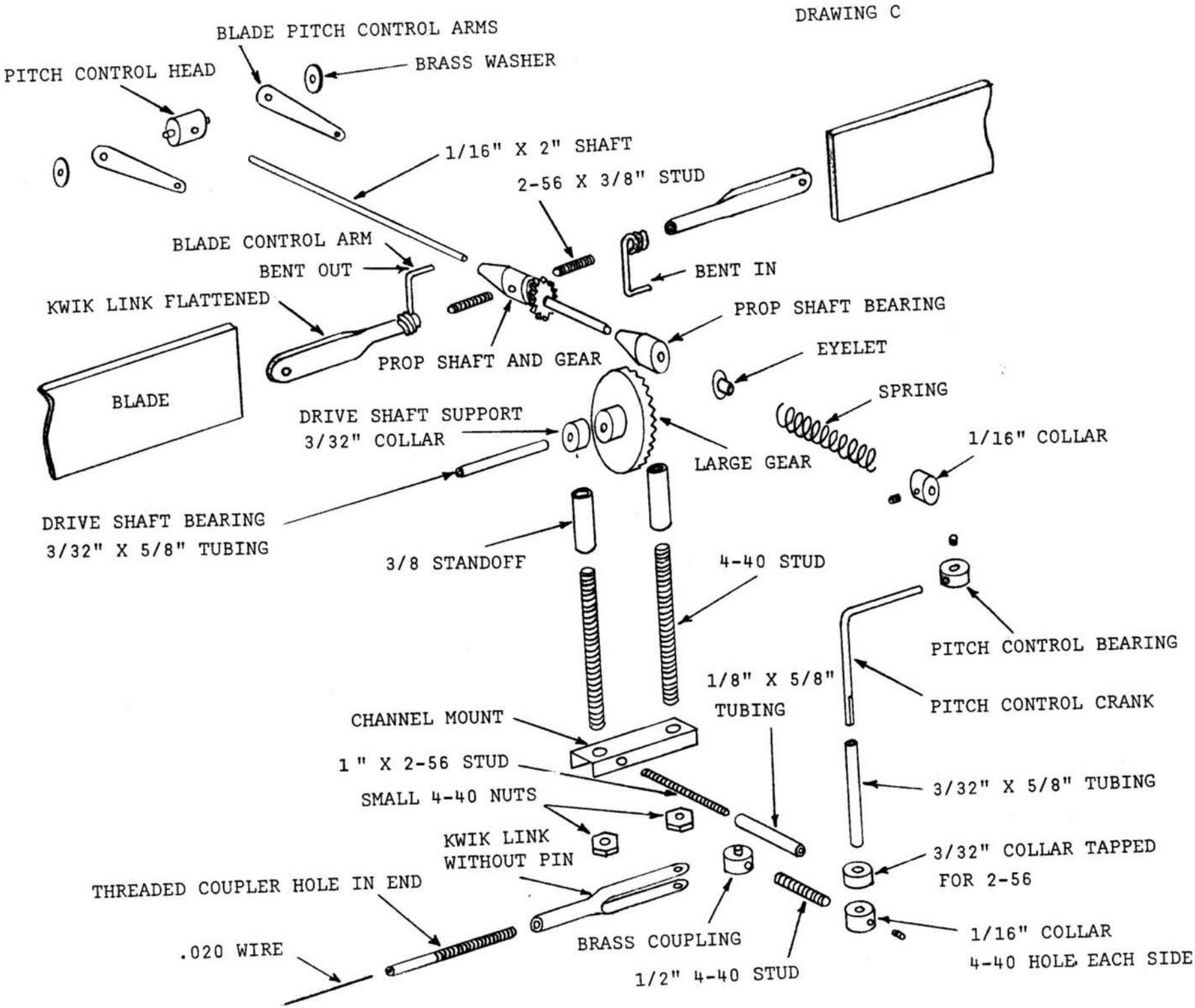

BEARING HOLE UP
BEARING BLOCK
TAIL BOOM MOUNTING PLATE
SIDE RAILS
SERVO MOUNTING BLOCKS
TAIL BOOM MOUNTING BLOCK
BEARING HOLE DOWN
LANDING GEAR BLOCK
SERVO MOUNTING PLATE

DRAWING B

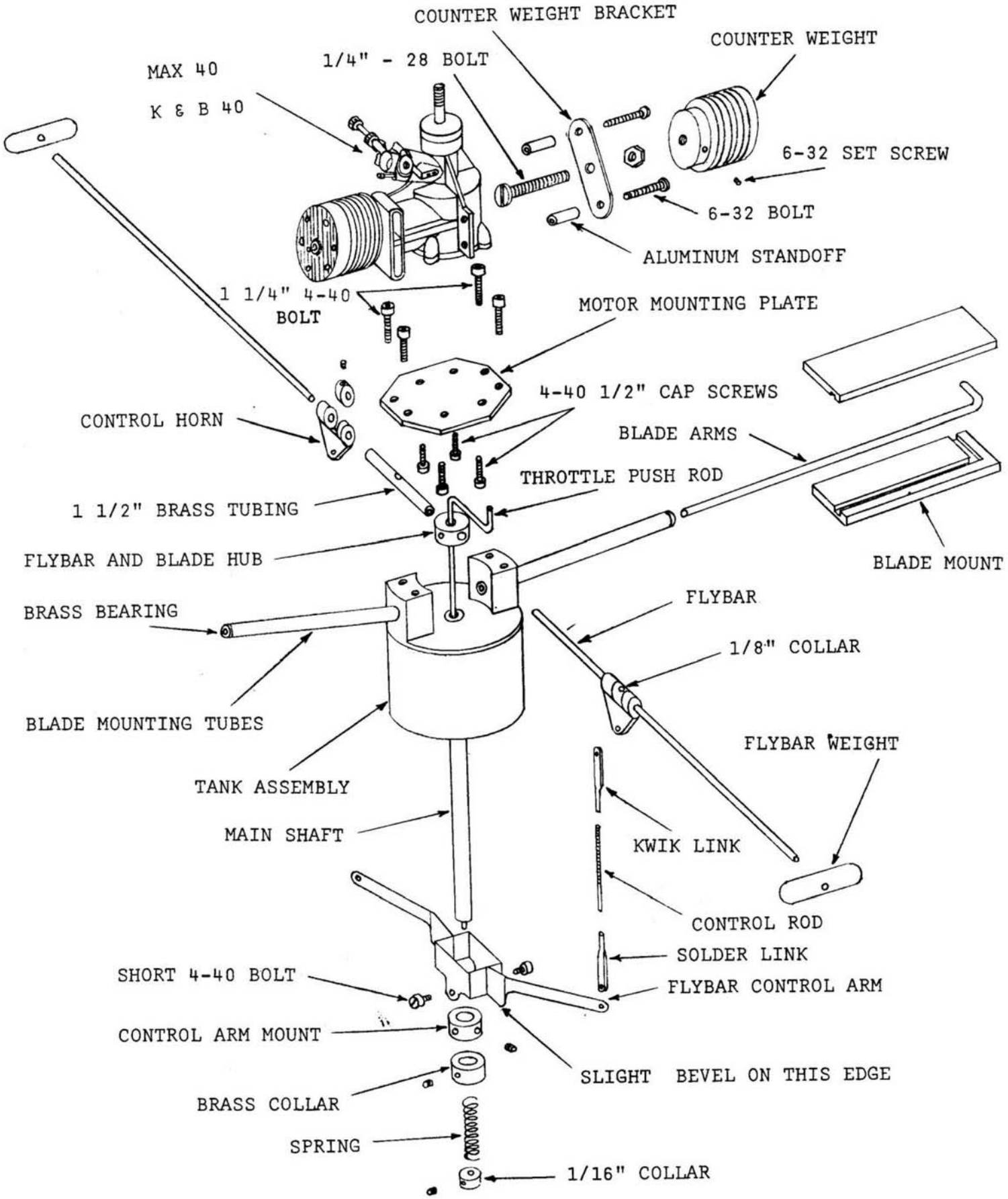


AFTER MAKING THIRD BEND, INSTALL WIRE ON TAIL BOOM AND MAKE LAST BEND.

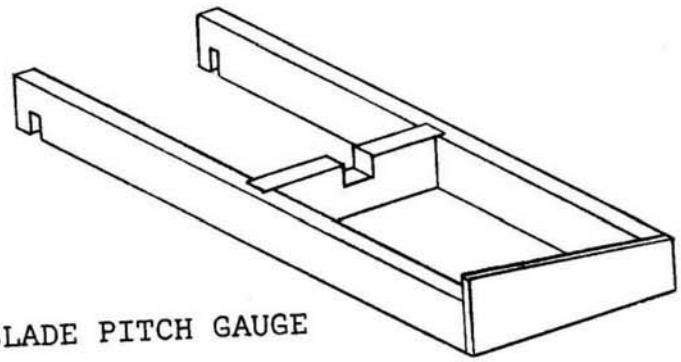
DRAWING C


BLADE PITCH CONTROL ARMS
BRASS WASHER
PITCH CONTROL HEAD
1/16" X 2" SHAFT
2-56 X 3/8" STUD
BLADE CONTROL ARM
BENT OUT
BENT IN
KWIK LINK FLATTENED
PROP SHAFT BEARING
PROP SHAFT AND GEAR
EYELET
BLADE
SPRING
DRIVE SHAFT SUPPORT
3/32" COLLAR
LARGE GEAR
1/16" COLLAR
DRIVE SHAFT BEARING
3/32" X 5/8" TUBING
3/8 STANDOFF
4-40 STUD
PITCH CONTROL BEARING
1/8" X 5/8"
TUBING
PITCH CONTROL CRANK
CHANNEL MOUNT
1 " X 2-56 STUD
3/32" X 5/8" TUBING
SMALL 4-40 NUTS
KWIK LINK
WITHOUT PIN
3/32" COLLAR TAPPED
FOR 2-56
THREADED COUPLER HOLE IN END
1/16" COLLAR
4-40 HOLE EACH SIDE
.020 WIRE
BRASS COUPLING
1/2" 4-40 STUD

DRAWING D

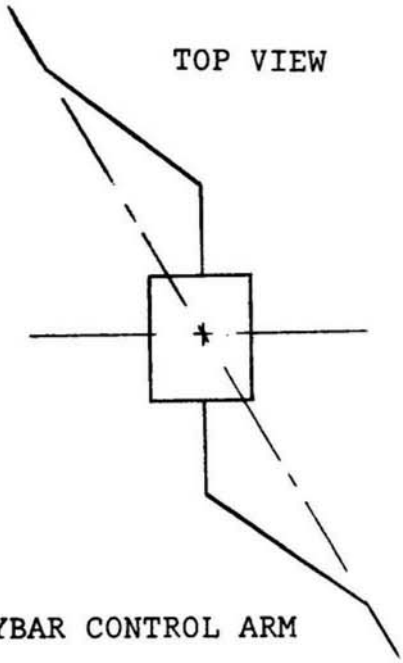

COUNTER WEIGHT BRACKET
COUNTER WEIGHT
1/4" - 28 BOLT
MAX 40
K & B 40
6-32 SET SCREW
6-32 BOLT
ALUMINUM STANDOFF
1 1/4" 4-40 BOLT
MOTOR MOUNTING PLATE
4-40 1/2" CAP SCREWS
CONTROL HORN
BLADE ARMS
THROTTLE PUSH ROD
1 1/2" BRASS TUBING
FLYBAR AND BLADE HUB
BLADE MOUNT
BRASS BEARING
FLYBAR
1/8" COLLAR
BLADE MOUNTING TUBES
FLYBAR WEIGHT
TANK ASSEMBLY
MAIN SHAFT
KWIK LINK
CONTROL ROD
SOLDER LINK
SHORT 4-40 BOLT
FLYBAR CONTROL ARM
CONTROL ARM MOUNT
SLIGHT BEVEL ON THIS EDGE
BRASS COLLAR
SPRING
1/16" COLLAR

DRAWING E



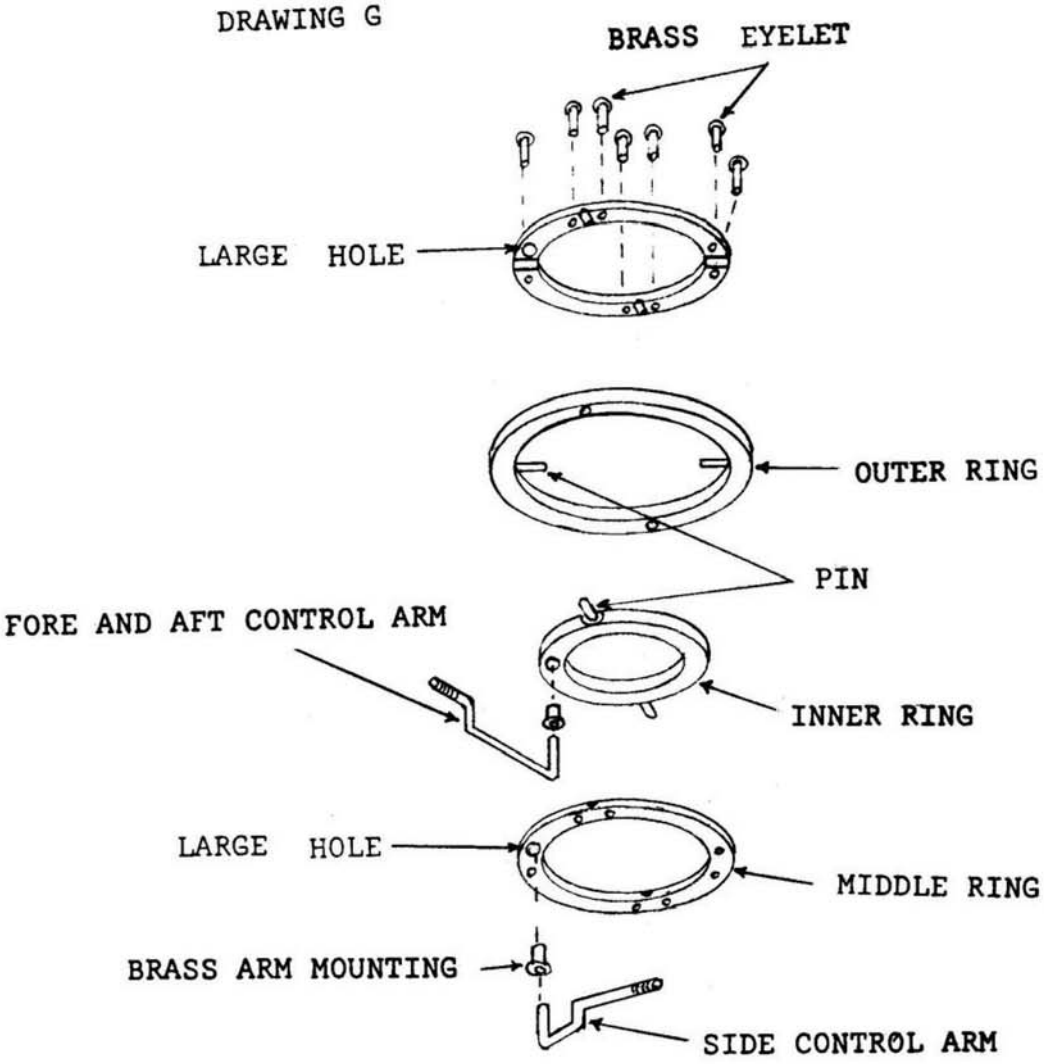
BLADE PITCH GAUGE

DRAWING F

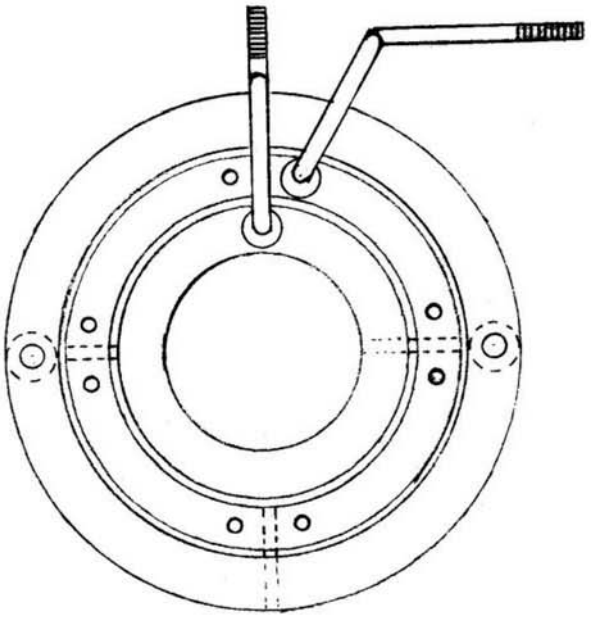


FLYBAR CONTROL ARM

DRAWING G

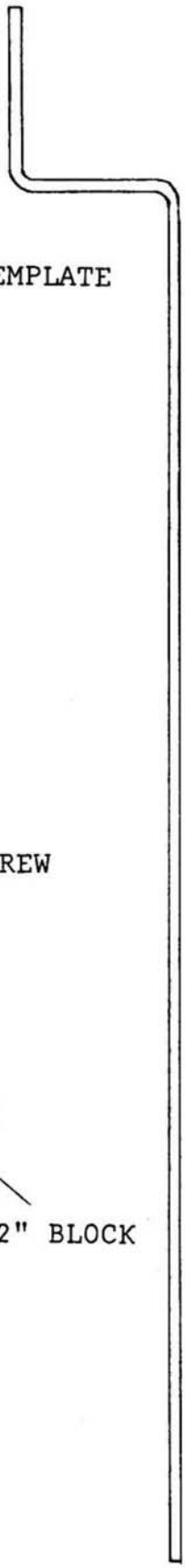


DRAWING H



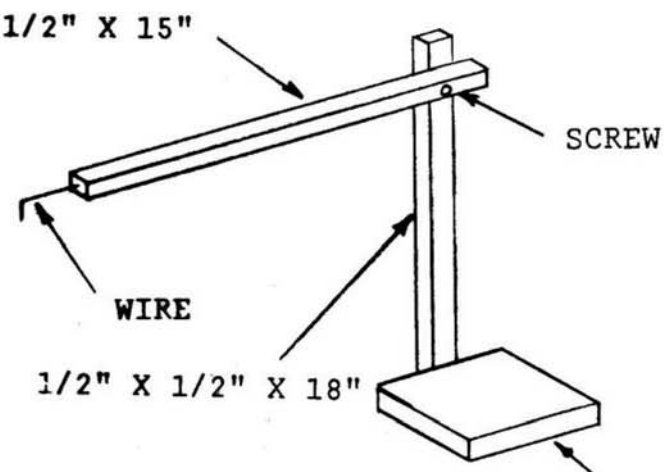
BOTTOM VIEW

DRAWING I

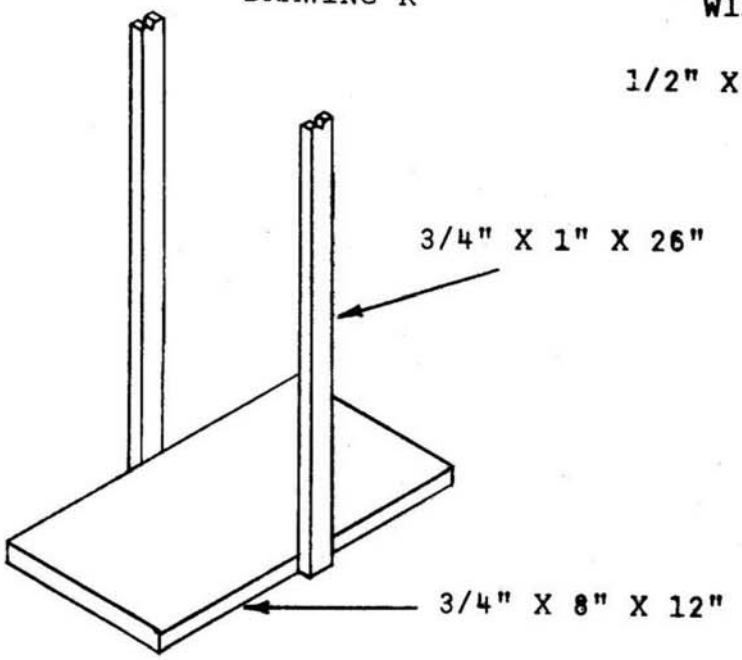


THROTTLE PUSH ROD TEMPLATE

DRAWING J

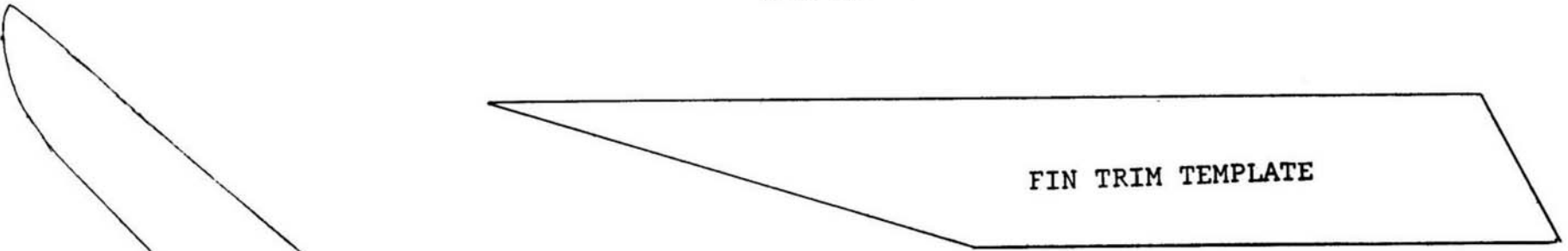


DRAWING K



ROTOR BALANCE STAND

DRAWING L



FIN TRIM TEMPLATE

SIDE TRIM TEMPLATE

HELICOPTER PARTS LIST

PART NO.	QUANTITY	DESCRIPTION	COST
		Wood Parts	
1	2	Side Rails, Pine	$1.00
2	2	Bearing Blocks, Hardwood	1.00
3	1	Landing Gear Block, Plywood 1/2"	1.00
4	1	Servo Mounting Plate, Plywood 1/8"	.35
5	2	1/2" x 1/4" Servo Mounting Rails, Pine	.25
6	2	1/4" x 1/4" Servo Mounting Rails, Pine	.25
7	1	Tail Boom Mounting Plate, Plywood 1/8"	.75
8	1	Tail Boom Mounting Block, Pine	.75
9	1	1/16" x 2" x 8" Balsa Stab	.50
10	1	Stab Mounting Block, Balsa	.20
11	1	1/32" Plywood Fin	.40
12	2	Main Rotor Blades 1/4" x 2 1/2" x 18", Balsa	3.00
13	4	Main Rotor Blade Doublers, Plywood 1/8"	1.50
14	2	Tail Rotor Blade, Plywood 1/32"	.50
15	4	Main Rotor Blade Mount, Plywood 1/8"	1.50
16	2	Blade Tip Weight Mounts, 1/4" dowell	.50
17	1	Tail Boom Plug & Rotor Protector Wire Mount	.25
		Wire Parts	
18	4	Landing Gear Legs, 1/8" Hard	$2.00
19	2	Flybar Arms, 1/8" x 8" Hard	.50
20	2	Main Rotor Blade Arms, 1/8" x 9" Hard	.75
21	2	Blade Tip Weight Rods, 1/8" x 2" Hard	.25
22	1	Tail Rotor Drive Shaft, 1/16" x 24" Hard	.25
23	1	Tail Rotor Control Cable, .020 x 36"	.20
24	1	Tail Rotor Protector, 1/16" x 14" Hard	.15
25	1	Throttle Push Rod, 1/16" x 10" Hard	.10
26	1	Soft Copper Wire 10" Long, Rotor Protector Mount	.05
27	1	Throttle Control Rod, 1/16" x 6" Soft	.10
28	1	Tail Rotor Pitch Control Shaft, 1/16" x 2" Hard	.10
29	1	Tail Rotor Pitch Control Crank, 1/16" x 1 3/4"	.10
30	2	Swash Plate Control Arms, Soft	2.00
31	2	Main Rotor Control Push Rods, 6" Kwik Link Rods	.30
32	2	Flybar Control Push Rods, 1" Kwik Link Rods	.20
		Aluminum Parts	
33	1	Engine Counter Weight	$4.00
34	2	Engine Counter Weight Stand Off	.75
35	1	Engine Counter WEight Mounting Plate	.75
36	1	Engine Mounting Plate	2.00
37	1	Tank Cover and Blade Mount	25.00
38	1	Fuel Tank	13.00
		Brass Parts (Machined)	
39	2	Blade Tip Weights	$1.00
40	2	Flybar Weights	1.25
41	1	Flybar and Blade Hub	2.00
42	2	Flybar Control Arm Mounting	1.25
43	1	Fuel Tank Lock Nut	.20
44	2	Main Shaft Collars 1/4"	1.00
45	3	Kwik Link Pivots, Swash Plate Control & Tail Rotor Control	1.00

PART NO.	QUANTITY	DESCRIPTION	COST
46	1	Easy Connector with Large Hole for Eyelet	.35
47	3	Easy Connector, Body	.75
48	6	Easy Connector, Washer (2 Tail Rotor Pitch Control Arm Mount)	.30
49	1	Threaded Coupler (Throttle Push Rod) Standard	.20
50	3	Standard 1/16" Collars	.60
51	3	Standard 1/8" Collars	.60
52	1	Guide for Tail Rotor Control Cable	.30
53	1	Threaded Coupler Tail Rotor Control .020 Hole	.30
54	1	Standard 3/32" Collar	.20
55	1	3/32" Collar with 2-56 Tap	.35
56	1	1/16" Collar with 4-40 hole, 2 Sides	.35
57	1	Tail Rotor Pitch Control Bearing	.30
58	1	Tail Rotor Pitch Control Head	1.25
59	1	Tail Rotor Blade Mount and Gear	3.00
60	1	Tail Rotor Bearing	1.00
61	1	Small Bevel Gear Bearing	1.50
62	2	Swash Plate Control Arm, Mounting	.50
		Brass Parts (Tubing)	
63	2	Landing Skids	2.00
64	1	Flybar Coupler	.75
65	1	1/16" Tail Rotor Control Cable End	.25
66	1	1/2" Stand Off (Shaft Guide)	.25
67	2	3/8" Stand Off (Gear and Bearing Mount)	.50
68	1	5/8" Stand Off (Control Arm Mount)	.25
69	2	5/8" Bearings (Tail Rotor Gear & Control Crank)	.50
70	8	Eyelet for Swash Plate	.60
71	1	Channel Mount Tail Rotor	1.50
		Nuts, Bolts, Screws, Washers	
72	1	1/4 - 28 x 1 1/4" Bolt	.30
73	1	1/4 - 28 Nut	.10
74	4	4-40 - 3/8" Cap Screws	.50
75	5	6-32 Set Screws	.30
76	8	4-40 Set Screws	.40
77	2	6-32 x 1 1/4" Bolts	.20
78	2	6-32 Nuts	.10
79	2	#4 x 3/4 Flat Head Screws	.10
80	5	4-40 x 1/8 Bolts	.35
81	2	4-40 x 5/8 Bolts	.15
82	7	Standard 4-40 Nuts	.35
83	3	Small 4-40 Nuts	.20
84	2	2-56 Nuts	.15
85	8	4-40 x 1 1/4" Bolts	.75
86	1	6-32 - 1/2 Bolt	.10
87	3	2-56 x 1" Stud	.30
88	48	#4 x 3/8" Sheet Metal Screws	1.50
89	30	Flat Washers	.50
90	1	#2 x 5/8 Sheet Metal Screws	.10
91	3	4-40 x 1/2" Bolts	.25
92	2	4-40 Blind Nuts	.15

PART NO.	QUANTITY	DESCRIPTION	COST
		Nylon Parts	
94	1	Swash Plate, 4 Rings	$14.00
95	1	Control Horn (Motor Control Mount)	.30
96	1	Bellcrank (Motor Control)	.40
97	1	Small Bevel Gear on Main Rotor	2.00
98	1	Large Bevel Gear on Main Rotor	4.00
99	1	Large Gear on Tail Rotor	2.00
100	2	Flybar Horns	1.00
101	1	Small Bevel Gear Mount & Bearing	.50
102	1	Bellcrank Bearing	.10
103	1	Nylon Tubing 4" Tail Rotor Control Cable Housing	.20
		Springs	
104	1	Throttle Control	.30
105	1	Tail Rotor Control	.30
106	2	Main Control Push Rods	1.00
107	2	Tail Rotor Control Arms on Blades	1.00
		Miscellaneous Parts	
108	3	Standard Kwik Links (on flybar & Throttle)	1.25
109	3	Kwik Links (no Pins, on Main Push Rods & Tail)	1.25
110	2	Kwik Links (no Pins, and Flattened Blade Mount)	1.50
111	4	Solder Links (on Flybar and Main Push Rod)	1.50
112	2	Flybar Control Arm (Steel Stamping)	3.00
113	4	Landing Gear Mounting Lugs	.25
114	1	Front Body Shell	5.00
115	1	Rear Top Body Shell	2.00
116	1	Rear Bottom Body Shell	3.00
117	1	Canopy	2.00
118	1	Brass Eyelet Flared Motor Control Pivot Bearing	.10
119	2	Main Shaft Ball Bearings	10.00
120	16	Servo Mounting Grommets	.50
121	1	Plastic Bottom Shell	.50
122	1	Tail Boom	7.50
123	1	Brass Eyelet Tail Rotor Spring Holder	.10
124	2	Tail Rotor Pitch Control Arms	.50
125	1	Fiber Washer Gasket for Fuel Tank Bottom	.20
126	1	Main Shaft 1/4" Steel 6"	6.00
127	1	Blade Pitch Gauge	2.00
128	1	Fuel Tubing 3"	.10
129	1	Assembly Instructions	3.50
130	1	Bottle Cement	1.00
131	1	Filler	.25
132	1	Squeeze Bottle	.75
		Tools	
133	1	4-40 Allen Wrench	.15
134	1	6-32 Allen Wrench	.15
135	1	Eyelet Tool	.35