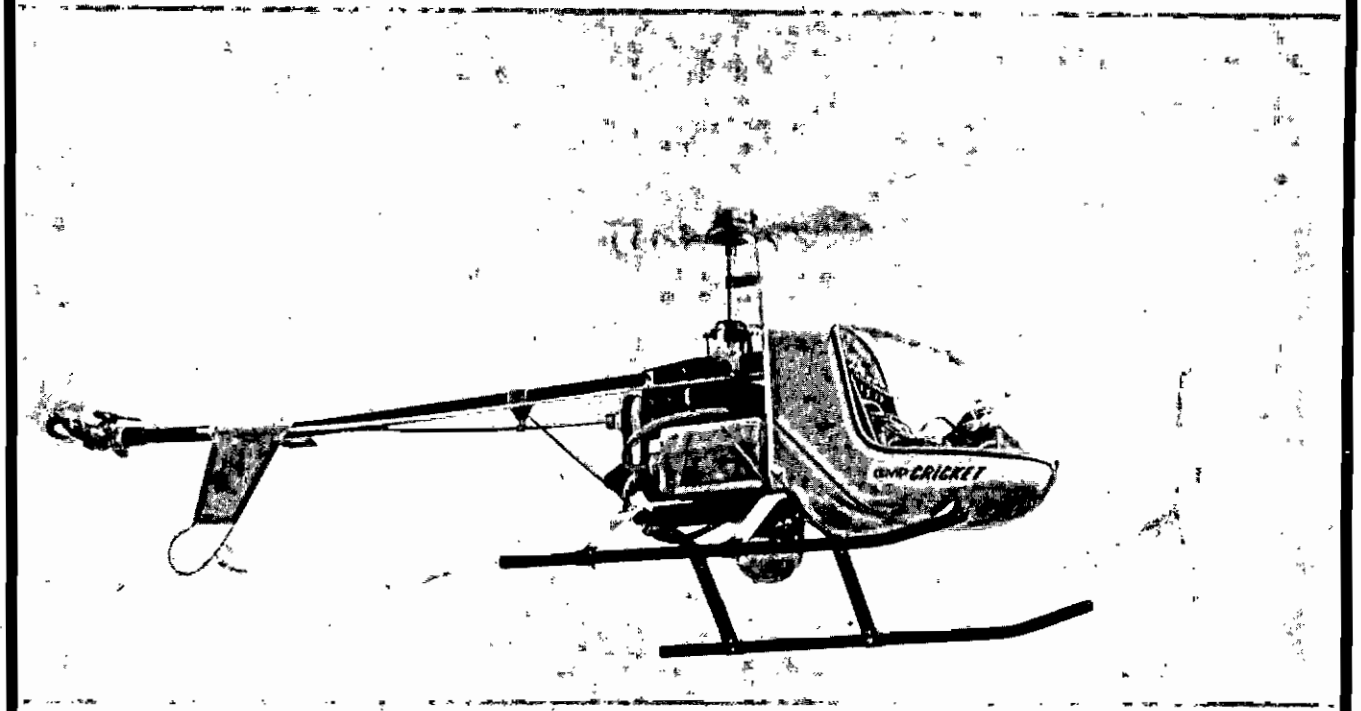
CRICKET



RC HELICOPTERS

ASSEMBLY

Instruction Manual

GORHAM MODEL PRODUCTS

QUALITY, PERFORMANCE & SERVICE

Congratulations! You have purchased the world's simplest and best performing small R/C model helicopter.

The history of R/C model helicopters is just over a short ten years. In that time we have seen rapid strides in technology and performance. We now have R/C model helicopters which can equal their fixed-wing counterparts in every respect, and exceed them in some. Imagine seeing a fixed-wing airplane hovering inverted.

While the pressure of competition between the flyers and the manufacturers has produced very sophisticated and excellent performing machines, we seem to have overlooked one simple fact - that there are very few people, still, who can fly an R/C helicopter. "Cricket" has been developed, therefore, with this main objective in mind: to produce a machine which the learner can build easily, adjust simply and learn to fly in a short time.

Another objective which we had in the design of "Cricket" was to produce a durable machine - one which would be simple, well engineered and manufactured, and easy and cheap to repair after a crash. We believe that we have achieved the two main objectives of a helicopter: simple and easy for the beginner to build and fly, but at the same time possessing good flying qualities and inexpensive repairability. What we did not realize we were producing at the beginning was an R/C model helicopter with such controlability that it has proved to be very attractive even to the expert as his second or sports machine.

Because it is so small it can be flown in restricted spaces. Because of its engine size, the noise level is low, and we believe that "Cricket" may well be the first R/C model helicopter to break the barrier of costs, dependability and attractiveness to the beginner.

We urge you to follow the instructions as faithfully as you can, not to give up if things don't seem to go right at the beginning, call us or any of your helicopter flying friends when you have a problem and come join us in this wonderful new world of R/C model helicopter flying.

ASSEMBLY NOTES

General

This kit has been prefabricated to the maximum possible degree and you will only need simple tools to assemble and adjust this R/C model helicopter. The design has been very carefully thought out and we strongly urge you not to change any of the design features without duly considering the effect of this on other working parts of the helicopter. "Cricket" has been over one year in design and development and this time has been used to simplify and improve the design as much as possible. A simple aircraft is usually lighter and more dependable and, for these two reasons, will fly better.

"Cricket's" parts are dimensioned in inches and the main shafts are fractional sizes. However, there is a universal move in the world now toward the use of the metric system and it is also true in the design of small mechanisms that the metric hardware provides a more effective means of fastening parts together than the fractional hardware. "Cricket", therefore, is a hybrid, or combination, of fractional dimensioning and sizing, with the technical design advantages of using the metric hardware system. The only exception to this rule is where certain standard American model aircraft hardware could be used, such as 'wheel' collars and pushrods.

In order to make the best job of building "Cricket", we suggest that a table top or bench space is cleared and covered to avoid damage to the surface. Always have good light available and you will need the following tools:

A small screw driver with about an 1/8" wide blade
a larger screw driver with about an 1/4" wide blade
a 7/32 nut driver (this fits the 3mm nuts used in "Cricket")
a pair of small needle nose pliers
Metric allen keys (provided in the kit)

The "Cricket" is a fully pre-fabricated R/C model helicopter. All of the metal parts are completely finished; there is no filing or fitting to do. All of the plywood is die cut out for you so there is no sawing to do. The blades are finished and sanded and only require covering. However, any R/C helicopter requires careful assembly and adjustment before you can safely begin to enjoy your first flights. Don't try to hurry the assembly. "Cricket" is very simple and will go together very fast in any event. To understand each stage thoroughly will not only produce a better model, but will also mean that you will handle problems better when these arise during the early learning period.

All nuts or metal parts which do not have a nylon insert (that is, a 'lock nut') must be 'Loctited' to the screw. The (L) symbol will be used in the text wherever 'Loctiting' is needed. Both parts must be thoroughly clean of any oil or grease, otherwise the 'Loctite' will not work properly. The R/C model helicopter is a combination of pieces which are either turning, shaking or vibrating, and it is very necessary to make sure that all nuts and bolts are thoroughly tightened and locked. This should also be checked every few flights to 'catch' any of those nuts and bolts which may be loosening under the vibration. (Note: The 'Loctite' must be the non-permanent or removable type

The building notes which follow are structured in a sequence which enables you to build "Cricket" in the most simple and fast manner. Try and be patient and only open the bags in the sequence called for, except, of course, for the hardware bag which must be opened at the beginning, and the necessary nuts, screws, bolts and washers taken out as required by each stage. You should be able to complete and be attempting to fly "Cricket" well within a week of buying the kit. An experienced R/C helicopter builder could assemble "Cricket" and be flying the next day.

You will need two other items as well as the "Cricket" kit. One is the engine and the other is the radio.

The Engine

The "Cricket" was designed to fly with a .25 cu. in. Schneurle ported engine. Most of the test flying has been done with the 'O. S. .25 FSR' and the 'O.S. .28 FSR' . Both of these engines perform well and we were encouraged by the fact that the "Cricket" will take off and fly on less than half throttle with these engines. We expect a variety of engines to be used, and we have designed the engine mounting blocks to accommodate most well-known engines so there will be no fitting to do in this respect either.

We anticipate that "Cricket" will fly with any good engine, from .19 up, and that it will fly well at pressure altitudes of at least 7,000 feet, especially if a good .28 Schneurle engine is used.

It should be noted that "Cricket" does not have a cooling system. This has been done deliberately. It is good design practice to get as much of the engine power available as possible to the main rotor system. A significant percentage of power can be

lost in cooling the engine. Of course, this is a trade-off between the extra complexity, weight, and the need for, a forced air cooling system for the engine. The harder the engine works, the hotter it gets, the more likely it is to need cooling. A well-designed helicopter can reduce or elimate the need for cooling by an optimum arrangement of engine and main rotor system. There is one other factor, however, which also helps in the cooling process. You will notice that "Cricket's" engine is mounted by two solid aluminum blocks to a thick main structural plate. This has been done deliberately so that some of the heat generated by the engine can be conducted into the main helicopter frame, which then provides an effective 'heat sink'. Convection, or air flow, cooling is also provided by mounting the engine in such a way that the cylinder head projects into the airflow of the main rotor blade system and also the forward flight air flow. To further improve convection cooling it is advisable to use a heat sink mounted on the engine cylinder head. These heat sinks are now available for nearly all small engines and they should be fitted so that they are in line with the forward line of flight airflow, projecting just outside the cabin profile. For beginners who will spend most of their time hovering, a vertical alignment of the heat sink might be better.

As far as cooling is concerned, bear in mind one other factor. Some .21 through .28 powered engines have a piston ring and some do not. With a 'ringless' piston, it is much more important to have a 'run in' period with the engine before using it in any helicopter. Even with a piston ring, because of the engine's small size and the high ratio of friction to power available, it is still suggested that the engine is given at least 30 minutes running on the bench. During this period you can also get used to the settings of your engine. When used in the helicopter, as with any other R/C helicopter, the engine must be run slightly 'rich' in order that there is sufficient oil flow to maintain the lubrication required and, hence, the cooling. If the above proceedures are adopted and a suitable heat sink is used, "Cricket" will operate very satisfactorily in temperatures up to and exceeding 85 degrees and at pressure altitudes up to 7,000 feet.

Radio

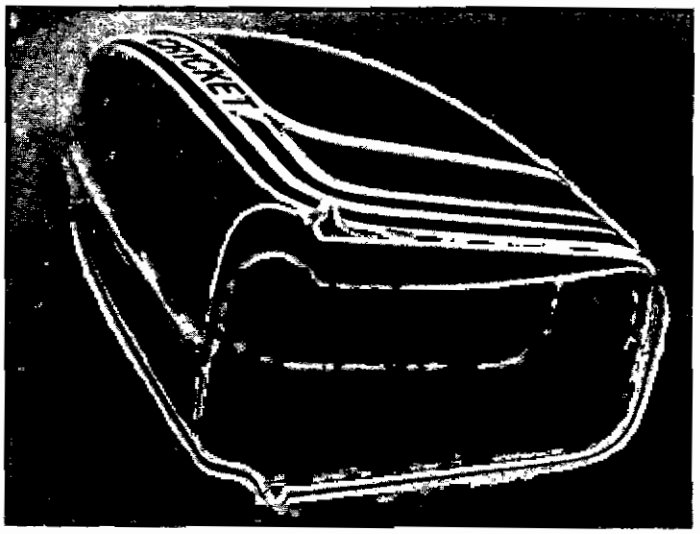
Since weight is one of the primary enemies of efficient flight, and "Cricket" is a very small helicopter, it is naturally best to keep the radio installation as light as possible. The normally available 4 channel radio is fine for "Cricket". You do not need any special receivers. Most 4 channel receivers available will fit well into the space provided.

So far as the servos are concerned, it is preferable to use the now widely available 'micro' servos in order to get a compact radio installation and also to reduce the airborne radio weight. However, the "Cricket" will operate with servos as large as can be fitted into the servo tray arrangement. With the larger servos you may have to cut the servo openings al ong one edge to permit fitting of the servos. We have not found any radio interference problems with "Cricket" and a number of different radios have been used.

The flight battery pack can be any size between a 220 ma hour to a 450 ma hour capacity. In the case of the larger battery, it is preferable to use one of the flatter packs which will then fit more conveniently under the lower servo tray.

Details of the installation of the radio is covered later in the "Radio and Controls Installation" section of this manual.

Now, let's "do it to it" and start building "Cricket". When the basic assembly has been completed you will find sections in this manual which will guide you through the setting-up phase and will give instructions on how to commence learning to fly.



BUILDING THE CABIN

The cabin is made of a special plastic designed to resist fuel and the vibrations experienced in a helicopter. To assemble the canopy, cut the flat flange all the way around to a width of about 1/8". Then tape the two halves together in three or four places with paper masking tape so that they are in the correct position relative to each other. Lightly tack

the canopy halves together with a cyanocrylate adhesive in several places and wait for a few minutes until the adhesive has thoroughly set. You can then flow the adhesive around the rest of the joint. Finally, as an insurance against the canopy joint failing during vibration or rough landing, it is advisable to cut some scraps of the excess canopy material into several pieces about 1/2" x 3/4". These pieces can be glued inside the canopy across the joint in several places. The canopy can now be painted on the outside using an epoxy or a polyurethane paint. The paint line can be finished neatly using a 1/4" trim tape. If you wish to tint the clear part of the canopy, this may be done by spraying Testor's transparent tint on the inside.

STAGE 1 - MAIN FRAME AND LANDING GEAR

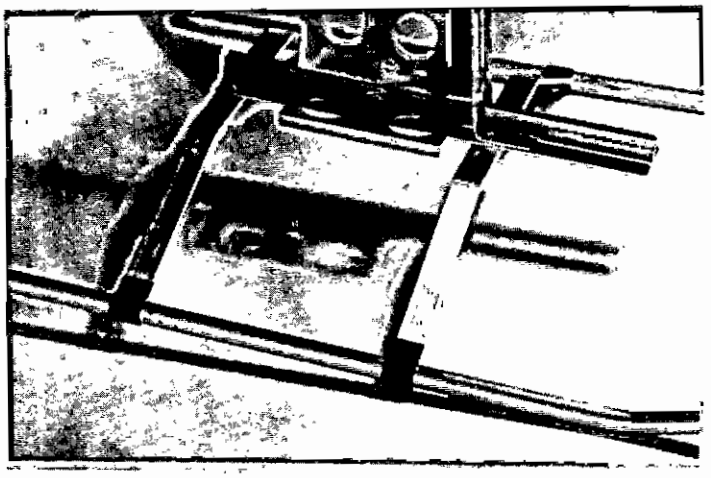
Open bag #1 which contains all the parts necessary for this stage. Also select from the hardware bag the following hardware:

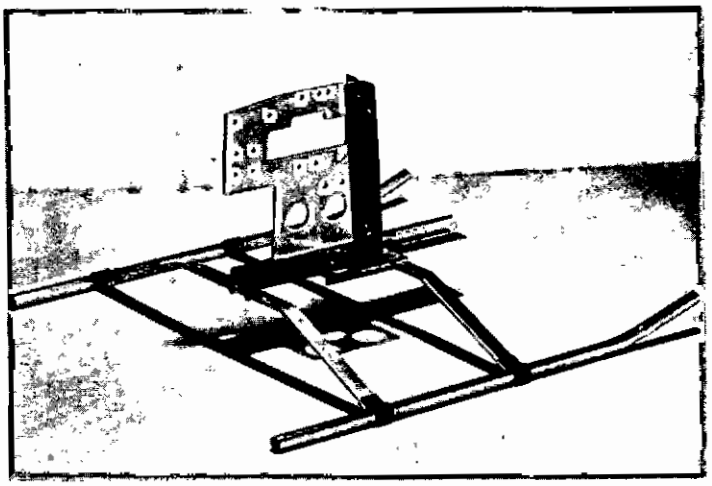
6 - **3x10mm Pan Head Screws**
6 - **3x12mm Pan Head Screws**
12 - **3mm Lock Nuts**

Use the four 3x10mm pan head screws and 3mm lock nuts to fix the clamps to the cross struts. The position of the clamps on the skids is such that 2 1/2" of skid projects behind the rear clamp. The centerfold drawing is one-half scale and can be used for reference at any time during the building process. Please note that the rear cross strut has two extra holes for the support wires for the tail boom, and also that both cross struts must be assembled so that the two main mounting holes which are about 3/4" apart will be to the right hand side of center. This is because the helicopter main frame is off-set to the right in order to counteract for the main shaft and engine being on the left hand side of the frame.

Now take the lower frame angles, and note also that there is a right and left hand angle. Assemble these, one to each side of the main frame, using TWO 3x12mm pan head screws and 3mm lock nuts. Note, however, that the tank mounting bracket must also be retained by these two screws on the right hand side of the body before the nuts are put on. The tank mounting bracket must be fitted so that the flanges point down and so that the single large hole is nearest to the main frame.

Now assemble the vertical frame angles and notice again that there is a right and a left. Also note that the bent tab at the lower end of the angle should face forward on each side. Secure these two angles to the main frame with two 3x12mm pan head screws, and two 3mm lock nuts. Do not tighten completely at this point. Now put the assembled main frame onto the landing gear and, using two 3 x 10mm pan head screws at the rear and two 3x12mm pan head screws at the front, fit it onto the landing gear cross struts. Note that the front screw goes through the bent tab of the front angles, then the lower angles and finally through the landing gear cross strut. Secure underneath all of the four screws with a 3mm lock nut, and then tighten all nuts and bolts securely including the two which hold the front frames to the main plate. You should now have an assembly that looks like the



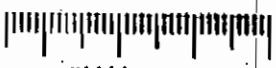


one shown. This completes the assembly of the main frame and landing gear. That did not take too long, did it?

STAGE 2 - ROTOR DRIVE GEAR TRAIN

Open bag #2 which contains all of the parts necessary to build the rotor drive gear train. Reference to the assembly drawing may be helpful for this stage. You will need the following hardware which should be selected before you commence:

8 - 3x30mm Socket Head Screws
1 - 3x20mm Pan Head Screw
8 - 3mm Lock Nuts
1 - 3mm Hex Nut
1 - 4x4mm Socket Head Set Screw

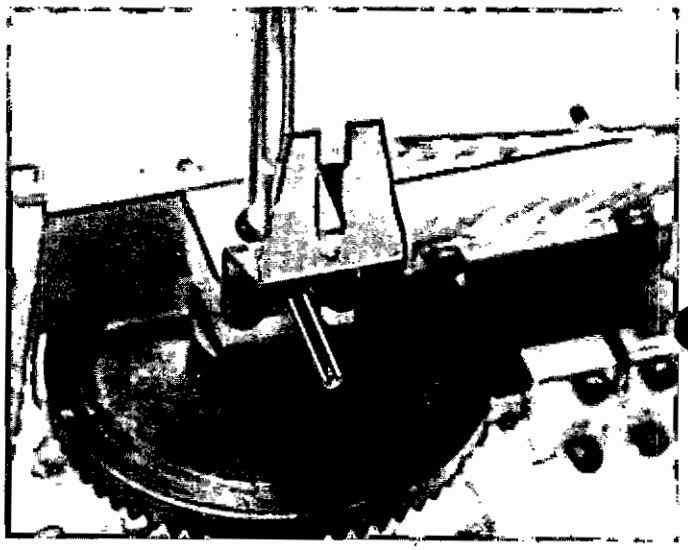


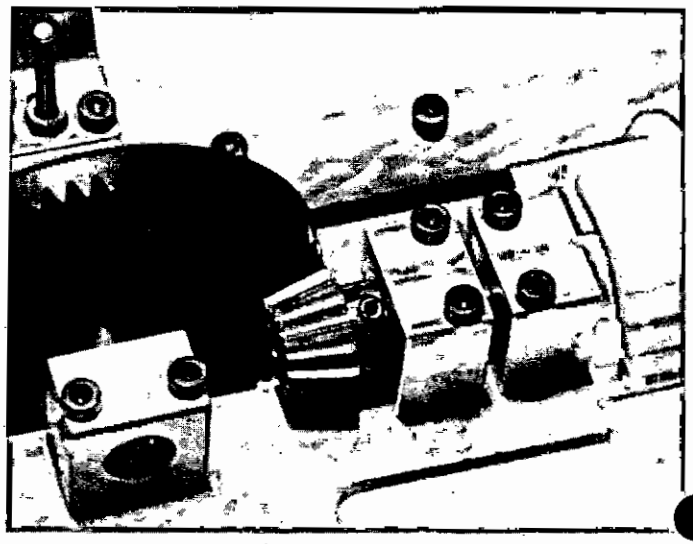
Take the main shaft, which is already fitted with the 60 tooth gear, and assemble in the following sequence. Above the gear (the opposite side to which the teeth face) fit the 9/32" OD x .20" brass sleeve.

Next, slide on to the shaft one bearing block, complete with bearing, which has an extra hole machined in one side. This extra hole should face away from the main frame. The exposed bearing surface should face down toward the brass sleeve and gear. On the end of the shaft, which protrudes from the other side of the gear (the side with the teeth) place the 9/32" OD x .40" brass tubing, followed by another bearing block, complete with bearing. This bearing block should be assembled such that the exposed bearing is facing the 60 tooth gear.

Place this assembly up against the left side of the frame and secure the bottom bearing block by means of two of the 3x30mm socket head screws and two 3mm lock nuts. The screw head should be on the same side as the bearing block, and the lock nuts on the opposite side of the main frame. The small clip with a 1/8" hole is used for the top end of the rubber bands which hold the fuel tank onto the fuel tank mounting bracket. Be sure to fit this clip under the FRONT 3mm NUT of the lower bearing block as shown. Before you fit the 3x30mm socket head screws to the top bearing block, take the swashplate locating bracket and fit a 3x20mm pan head screw inthe center hole with a plain nut facing outward (L). Tighten the nut and screw firmly to the locating bracket. This screw will form the pivot for the T-lever assembly which will be fitted later. Now fit the swashplate locating bracket onto the left side of the top bearing block, using the two 3x30mm socket head screws. Push the screws right through the block and the main frame to secure the top bearing block in the same manner as the bottom one. Fit two 3mm lock nuts and tighten. Fit the 1/4" ID washer on to the longest end of the 3" shaft up against the nylon pulley.

Then take the other two bearing blocks and fit them onto the 3" shaft on the same long end. The blocks should be fitted so that on the first block the bearing faces the nylon pulley, and on the second block the bearing faces the flat, or outside, end of the shaft. Now take the steel 15 tooth gear and fit the 4x4mm socket head set screw into the gear (L). Slide the gear onto the end of the shaft which has the flat and secure by tightening the 4mm set screw. Fit this sub-assembly onto the main frame using the 3x30mm socket head screws. Secure with four 3mm lock nuts on the right hand side of the frame in a similar way to the main shaft bearing blocks. See the main assembly drawing which will again be helpful here.

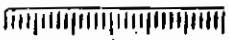




STAGE 3 - MOTOR DRIVE ASSEMBLY

Bag 3 contains all of the parts needed for the motor drive assembly. In addition, you will need the following items from the hardware bag:

2 - 3x10mm Socket Head Screws
2 - 3x5mm Socket Head Set Screws
4 - 3x30mm Socket Head Screws
8 - 3mm Washers (Oversized)
4 - 3mm Lock Nuts

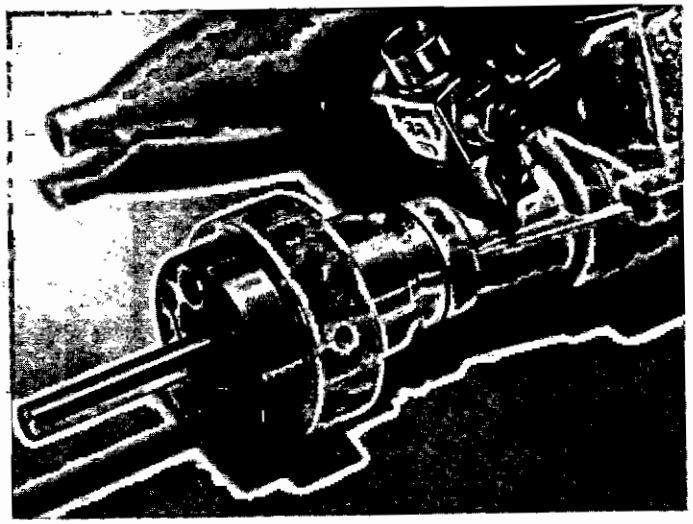

Millimeters

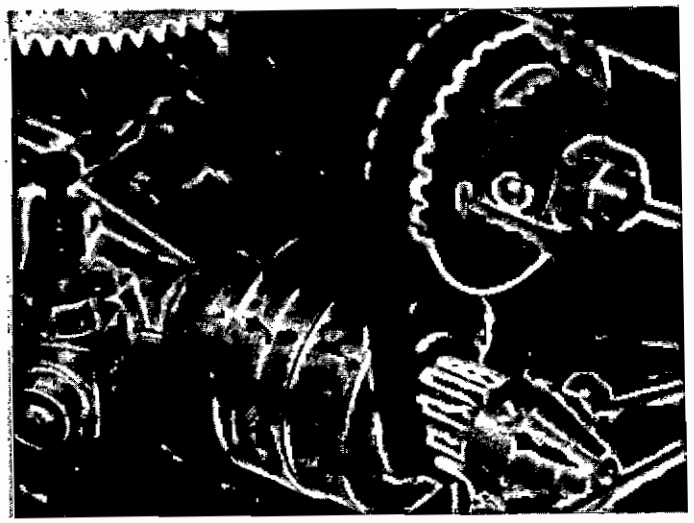
Fit the flywheel to the engine which you intend to use. Note that there is a 1/4" spacer washer in the bag. This is used as necessary to place the small drive pulley in the correct relationship to the large pulley in the intermediate shaft. The general assembly drawing will help you to decide if you need the spacer or not. If your engine has a 1/4" dia. shaft, then all you will need to do to fit the flywheel is to tighten up the 'prop' nut inside the counter bore of the flywheel. Make sure that you tighten well. The flywheel has two 1/8" dia. holes so that you may hold the flywheel with a 1/8" metal rod while tightening the 'prop' nut. The holes should also be used in this fashion when undoing the 'prop' nut. Do not use Loctite on this nut since it will make it difficult to loosen if you need to remove the flywheel.

Now fit the clutch and starting shaft on to the flywheel with the two 3x10mm socket head screws (L). Place the already assembled clutch bell on to the shaft and then fit the starting cone. Secure the starting cone with the two 3x5mm set screws (L) but make sure that a small gap (the thickness of note paper) is left between the cone and the small pulley. This is so that the pulley can rotate freely when the engine is at idle speeds.

Now place the drive belt over the large and small drive pulleys and fit the engine (using the universal mounting blocks) to the main plate. Four 3x30mm screws are used with double 3mm washers placed on each screw before the 3mm lock nuts are fitted and tightened up. The engine should be adjusted so that the drive shaft is approximately horizontal and the belt tension should be so that when the two sides are squeezed together with finger pressure, they have a gap between each side of about 3/4" The belt can and should be run quite slack - much more so than a Vee belt which relies upon tension and the resulting friction for its grip. The "Cricket" drive system effectiveness depends upon a relatively slack belt tension so as to minimize friction and, hence, transmission drive losses at this point.

The belt may be removed at any time by removing the starting cone and slipping the belt off the small pulley and off the 1/4" starting shaft. It may be refitted in the same way. The belt should be removed whenever the system is checked for correct line-up of the drive elements to the rotors, especially the setting-up of the tail drive wire and gearbox. Please refer to the assembly drawing for the correct line-up of the pulleys. Note, also, that "Cricket" has been especially designed so that you may use the standard airplane muffler with your engine.

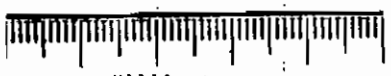




STAGE 4 - TAIL BOOM AND TAIL ROTOR GEARBOX ASSEMBLY.

Open bag 4 to commence the assembly of the tail boom and tail rotor gearbox. From the hardware bag select the following items:

2 - 3x25mm Socket Head Screws
7 - 3mm Lock Nuts
1 - 3x16mm Socket Head Screw
6 - 3mm Washers
2 - #4x3/16" 'PK' Screws
8 - 2x10mm Pan Head Screws
6 - 2mm Nuts
2 - 2mm Washers
2 - 3x10mm Pan Head Screws
2 - 3x12mm Pan Head Screws
2 - 4x4mm Socket Head Set Screw



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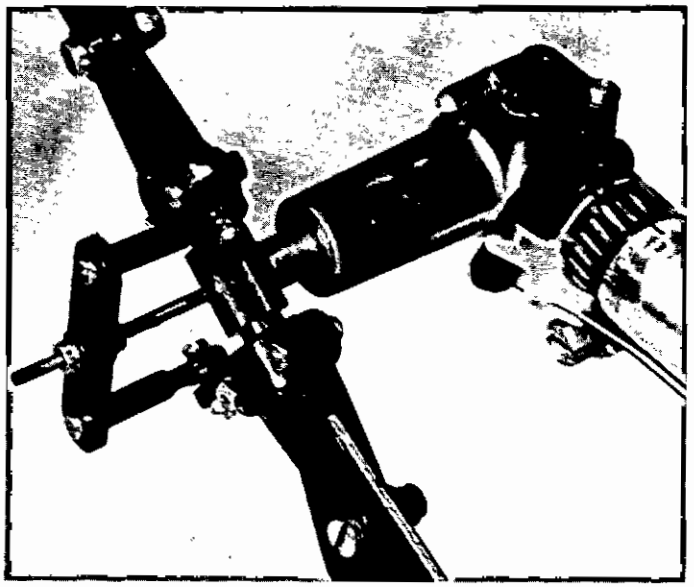
Gearbox

First we will complete the tail rotor gearbox. The gearbox has been assembled for you with the exception of the blade holders and the control linkages, to change the angles of the blades. There are four black plastic blade holders; two have a projection for the control ball, the other two do not. Fit one pair fo blade holders (that is to say, one with a projection for the control ball, and one without) on each side of the tail rotor hub. The cavities in the plastic blade holders will fit over the brass thrust washers. Now secure the four blade holders by four 2x10mm pan head screws and four 2mm nuts (L). The 5mm ball for varying the angle of the tail rotor blades is fitted onto the inside of the control arm of each of the blade holders by means of a 2x10mm pan head screw. The ball is trapped between the screw head and the inside plastic of the control arm, and a 2mm nut secures it on the other side of the blade arm (L). Fit the rotor blades temporarily, using the 3x12mm pan head screws and 3mm lock nuts.
Later on, in stage 6, we will check the correct positioning of the tail blades and finally tighten the retaining screws.

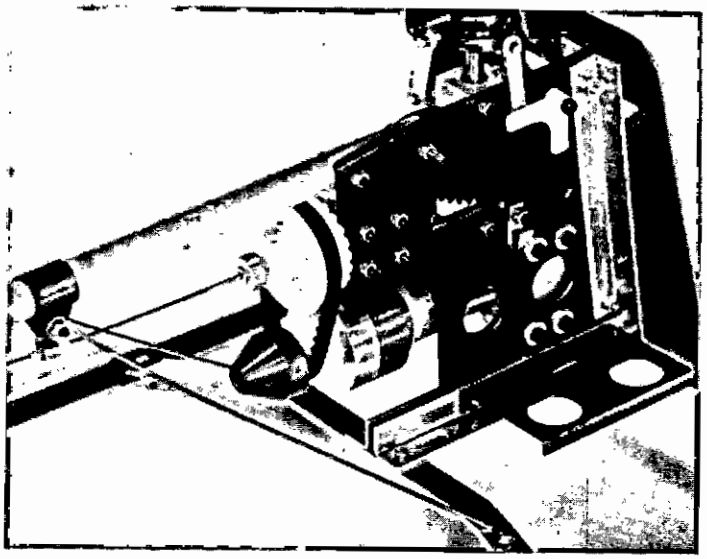
Remove outer wheel collar #163C, which holds pitch plate. Now remove pitch plate #167 and slide onto pitch wire #161, one #262 washer, then replace pitch plate, then another washer #262, then replace wheel collar #163C. Final adjustment will be made later.

Take two ball joints and fit them over the balls with the threaded end of the ball joint facing the control plate. Using a 2x10mm pan head screw, fix the ball joints to the control plate. The screws should be tightened sufficiently so that there is no play, but



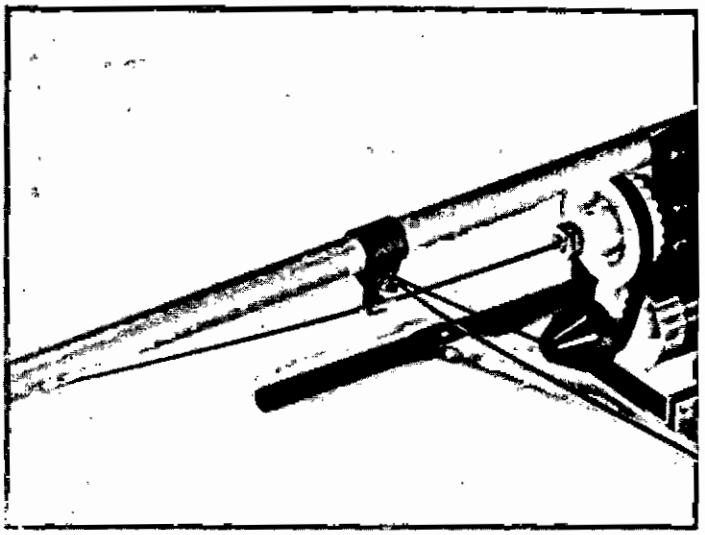
should not be over-tightened so as to damage the plastic material of the control plate. Now, if you move the control lever of the gearbox, the control rod should move freely in and out of the tail gearbox, and the result of this movement will be to change the angles of the tail rotor blades. For the correct settings of these angles, see the Servo and Controls schematic drawing. The tail rotor gearbox assembly is now completed.

Now take the tail tube, the tail brace bracket, the tail drive support bracket and the two tail brace wires. Fit the tail tube to the main plate by means of the 3x25mm socket head screws, using a washer underneath the head of the screw. Do not tighten completely. Fit the two control wires on to the cross



strut of the landing gear, using the 3x10mm pan head screws with a washer under the head of the screw and a lock nut on the underside of the rear cross strut. The two other ends of these brace wires should be bent and/or twisted into the right positions by a pair of pliers and they should then be clamped on either side of the tail support bracket, using a 3x16mm socket head screw, with a washer under the head and a washer under the nut on the other side. Note that the tail drive wire support bearing bracket is also held by this screw. It should be fitted onto the left side of the tail boom support bracket and directly next to it. Fit and tighten the 3mm lock nut but not completely at this point. Looking sideways at the helicopter, make sure that the tail tube, for the first ten or twelve inches, is running parallel to the lower edge of the main plate. This can be adjusted by sliding the tail clamp carefully along the tail boom, and when you have the position correct, then tighten all of the nuts and bolts that hold the tail boom in this position.

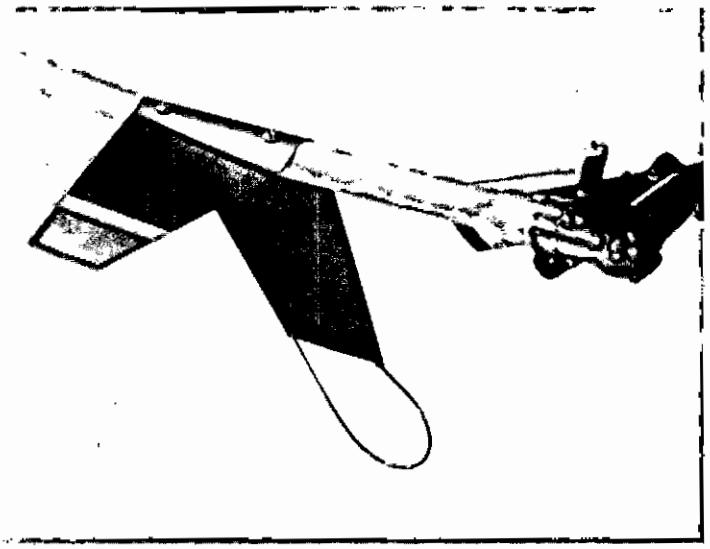
Take the tail drive wire and fit one end into the tail rotor gearbox input drive shaft. This is the shaft that has the two 4mm skt. hd. screws. Put a little Loctite on each of these screws. Insert the tail drive wire 1/2" into the center hole and tighten up the screws in such a way that the wire runs true. The screws should be adjusted carefully to achieve this. Fit the hose clamp loosely over the rear end of the tail tube and then insert the tail drive wire into the rear end of the tail tube. You may have to use a little patience in locating the hole in the inner tail drive bearing, which is located about 6" inside, from the rear of the tail boom end. After passing through this bearing, the tail drive wire should come out through the slot in the bottom of the tail boom. It should then be fed through the nylon bearing in the tail boom drive support bracket, and, finally, fed into the small hole in the rear of the intermediate shaft. Make sure, before you do this, that the 1/4" dia. collar with the 4mm dog point set screw is on the shaft. Now make sure the tail gearbox is rotated, so that it points to the right side of the model and that the shaft is at 90 degrees from the vertical and it is pushed fully home into the tail tube. The tail clamp may now be tightened up to retain the tail gearbox in this position. When this is done, you can then tighten the 4mm set screw in the 1/4" dia. collar, making sure it goes through the hole provided in the intermediate shaft, and locates on the flat poriton of the tail drive wire. When this has been done, the tail support bracket may be bent one side or the other, and/or pivoted slightly forward or back in order that the tail drive wrie runs freely within this bearing. This completes the tail gearbox and drive assembly.



Tail Fins

Take the tail fin assembly and you will note that there is one place where a sharp bend has been made, and that there are two holes for the two mounting screws. Using the two PK screws provided, fit the tail fin, as shown in the photograph, after coating the PK screws with silicone rubber to prevent vibration from loosening them. Wrap the fin around the tail boom until the longer portion (with the tail skid) forms the vertical fin and is perpendicular to the ground. The horizontal fin should be adjusted, also, by bending until it is horizontal and has a zero or slightly positive angle to the ground plane. The reason for the unusual bend in this item is to cancel out the angle at which the tail boom "kicks" up and permit the neutral angle to be set.

Except for the control hookup which is described in another section, this completes the assembly of the tail boom, tail fin and gearbox of "Cricket".

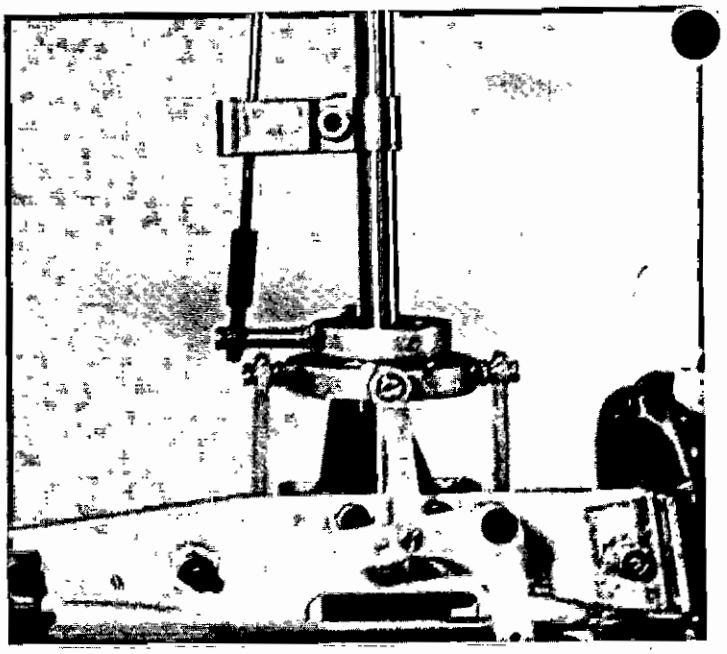


Stage 5 - ROTOR HEAD SYSTEM

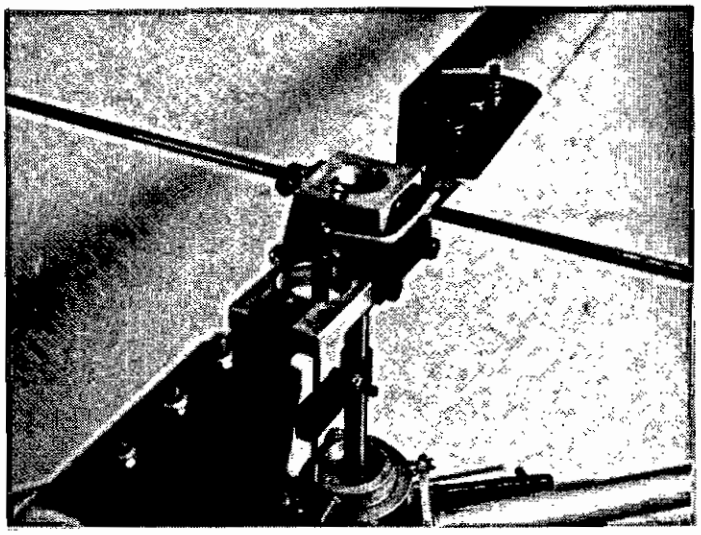
Open bag 5 and select the following hardware from the hardware package:

3 - 3x16mm Socket Head Screws
2 - 5/40 Lock Nuts
2 - 3x30mm Socket Head Screws
3 - 2x10mm Pan Head Screws
5 - 3mm Lock Nuts
1 - 3x5mm Socket Head Set Screw
1 - 2x20mm Pan Head Screw
4 - 2mm Nuts
3 - 1/8" dia. Collars
3 - 2mm Washers

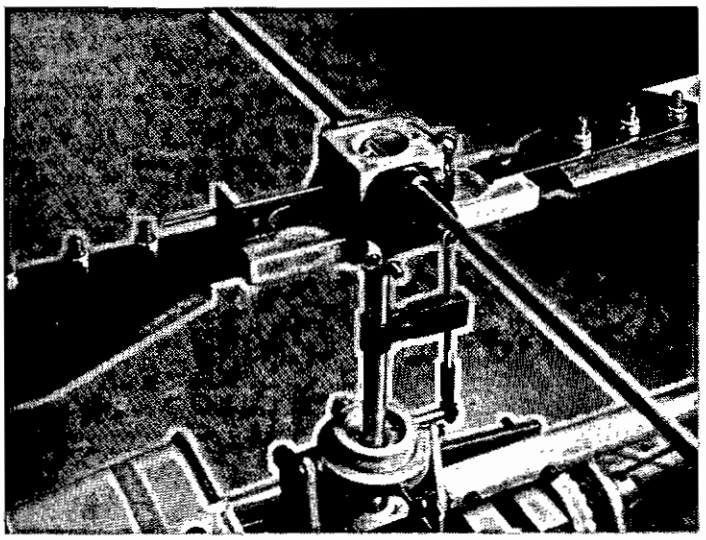
The first item to assemble from bag 5 will be the swashplate. The photograph shows a swashplate connected to all the control linkages and you will see that the lower ring of the swashplate has a larger diameter than the upper ring. Fit three 5mm dia. balls onto this lower ring, using three 2x10mm screws. Place a ball on to each screw, then run a 2mm nut up tight against the ball to trap it between the head of the screw and the nut (L). Fit one 2mm washer on each screw and fit each assembly into the outer ring of the swashplate in three places (L). Fit the swashplate locating wire (a 27mm long piece of 2mm dia. wire with a threaded portion on one end) into the remaining 2mm hole, using a 2mm plain nut to lock the wire into the swashplate (L).

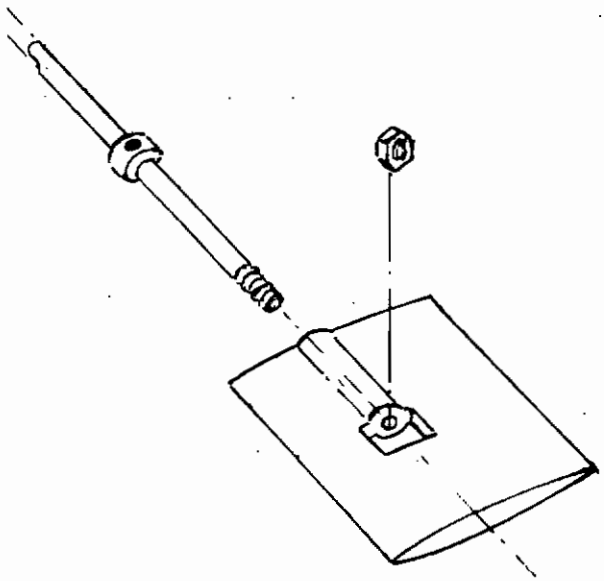


The upper ring of the swashplate (that is the one with the smaller diameter) has two 2mm tapped holes. Only one of them is used. Fit the 2x20mm pan head screw through the ball of the plastic ball joint provided. Then fit the 3/32" O.D. brass tube on to the screw thread which projects through the ball. Clamp up the tube and ball with a 2mm nut and then screw the whole assembly into one of the 2mm tapped holes of the swashplate upper ring until the nut fits tightly against the swashplate (L). Now in bag 5 (or on the carpet) you will find a small 1/4" 'O' ring. This should be inserted carefully inside the center hole of the swashplate so that it fits in to the groove made especially for it. The completed swashplate can be slid down the 1/4" shaft, being careful to insure that the 'O' ring does not come out of the groove while doing this. In order to help avoid this problem a small amount of Vaseline or similar grease can be used on the shaft. Move the swashplate down until the locating pin is in the center of the swashplate locating bracket (#C135). The 5mm balls will be hooked up to the controls in a later stage.

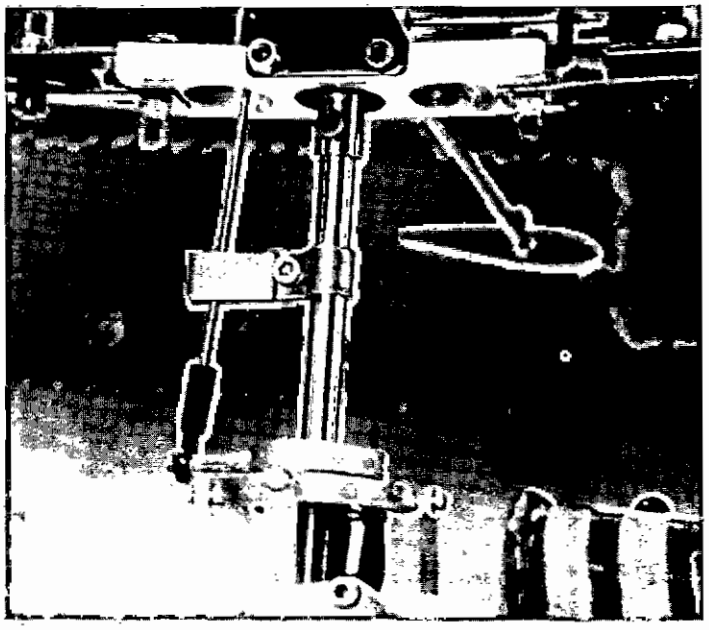


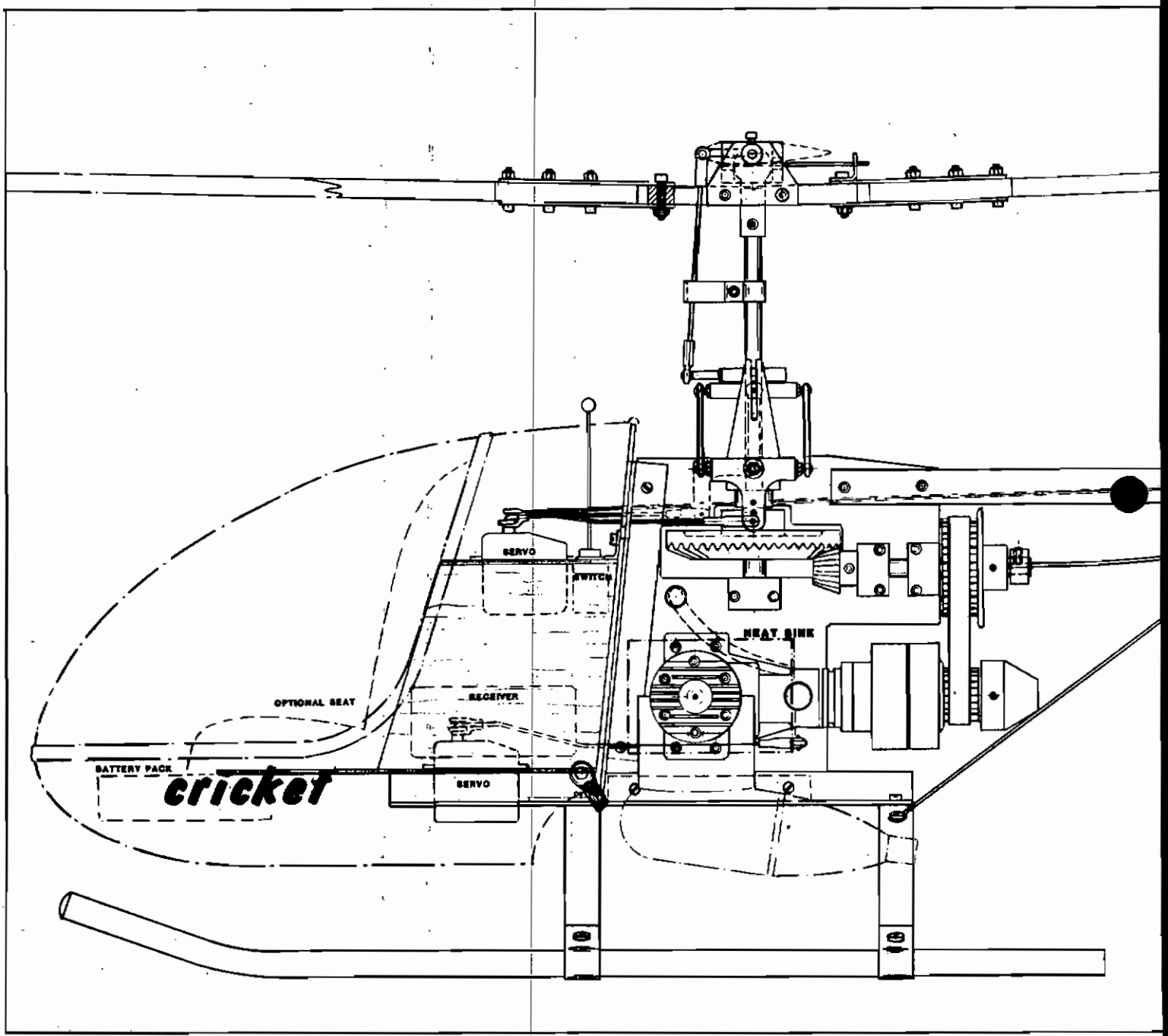
To install the flybar, first mark its center and then slide it into the rotor head. Next, fit one 1/8" dia. collar on one side of the head, then the flybar control arm onto the other side (see photos). Tighten the control arm (L) and collar (L) on the flybar, making sure the flybar stays centered and is completely free to rotate in the head (no binding in any position !). Fit the other two 1/8" dia. collars (one on each side). Press one 5/40 lock nut into the hole in each paddle. Now mix a little slow cure epoxy and put some on the ends of the flybar and thread the plastic paddle onto the flybar. The ends of the flybar should just protrude through the nut by one thread. Make sure that the paddles are in the same plane as each other and in line with the flybar control arm. Also be sure that the leading (shorter) edge of each paddle faces the direction of rotation of the rotor head (clockwise, looking down on the head). Now slide the 1/8" dia. collars outward so that they butt up tight against the paddles and tighten the set screws (L).

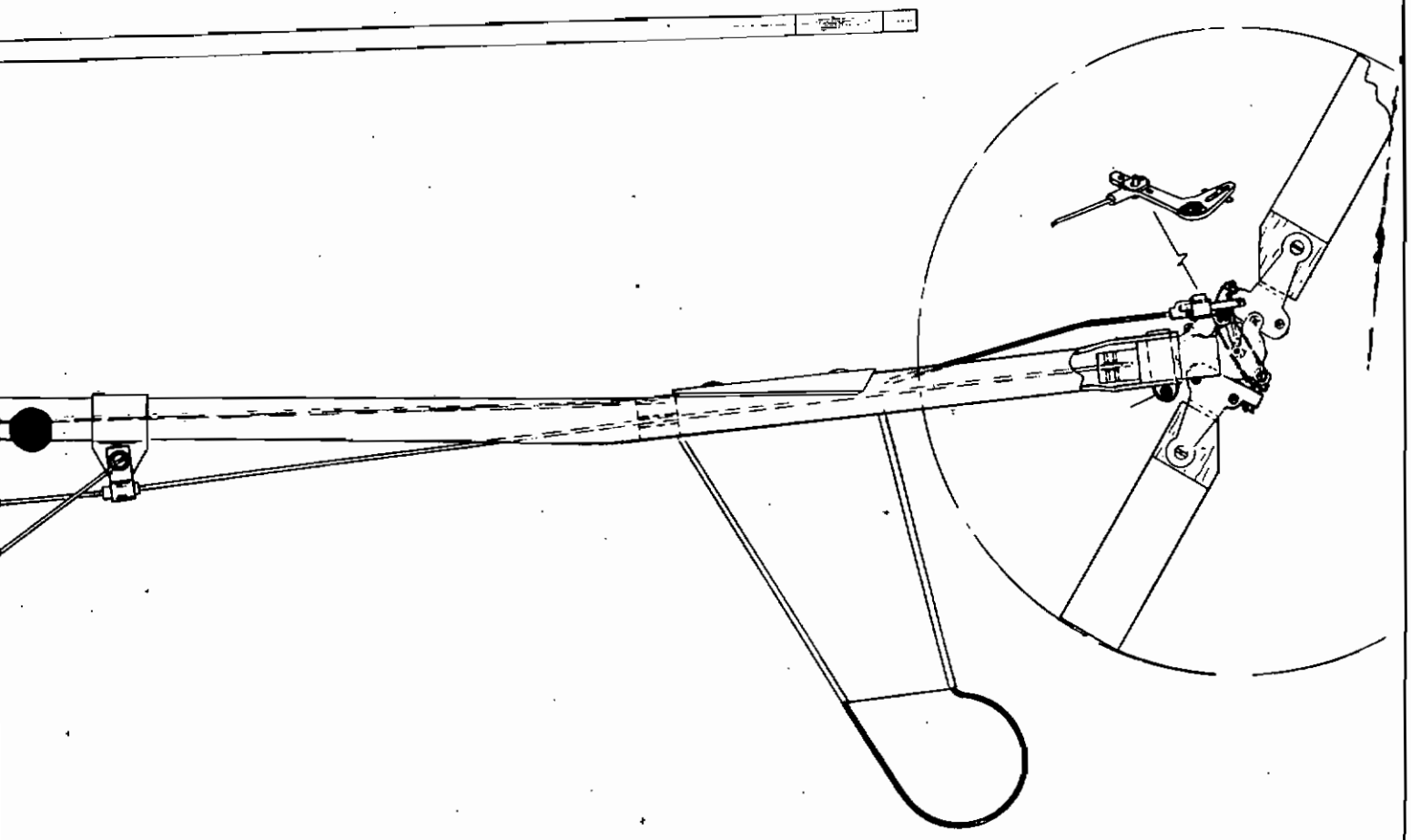




Fit the carrier to the main shaft above the swashplate but do not tighten it yet. Set the rotor head aside since the main blades will be fitted later befor the whole assembly is balanced. However, the 3x16mm socket head screw and the 3mm lock nut can be temporarily fitted into the top hole of the 1/4" rotor shaft until the rotor head is finally fitted. This completes stage 5.







Main rotor diameter ——— 35 inches
Radio control channels ——— Four
Flying weight ——— Four pounds
Engine ——— 21 to 25cu in

"CRICKET"

"25" Powered R/C Helicopter

designed by john gorham

GORHAM MODEL PRODUCTS
Craftsman Rd, Calabasas, California, 91302 U.S.A.

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SEPT 1980
ISSUE 3
DEC 1980

DRAWN JDS

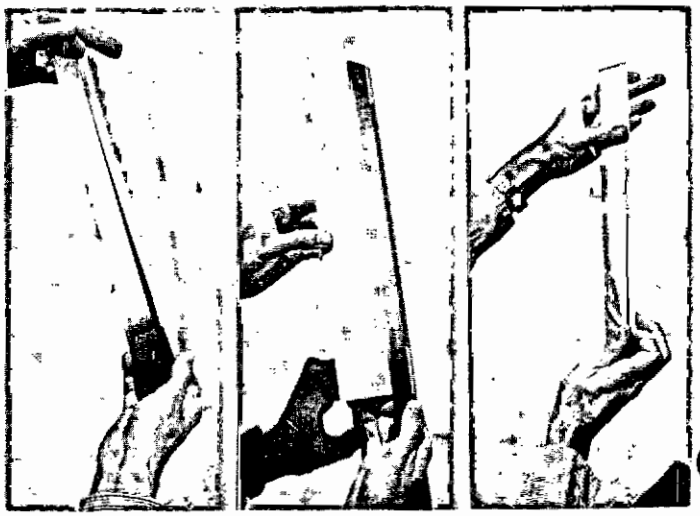
STAGE 6 - TAIL AND MAIN BLADE ASSEMBLY

Tail Blades

The main and tail rotor blades for the "Cricket" have been carefully selected from the same stock of wood so that the weights of each pair of blade should be very close and, hence, balancing the "Cricket" blades will present very little problem. First we will prepare the tail rotor blades for mounting on the model. You will notice that the blades are parallel all along their length. But is you look in the General Assembly drawing in the center of this book, you will see that it presents a more attractive appearance if the blades are tapered at an angle towards the inner end. Tapering the blades at this angle must be done carefully if you don't want to finish up with two left hand or two right hand tail rotor blades. (This can happen if you are not careful!) If you place a blade on the table in front of you with the flat portion on the table and the rounded leading edge to the right, then it is the lower left hand edge which should be cut at an angle. The same should also be done for the other blade, placing it on the table, flat in front of you, leading edge to the right, cutting off the lower left hand edge at an angle. The tail blades may be decorated as you wish, but it's usually preferable to not add any extra weight to them by using a foil covering. We prefer to use a clear dope or varnish on the blades to fuel proof, and leave them this way. You may prefer to give a few coats of colored dope and then, perhaps, a white or red strip at the tips so that the blades look like the blades of the full sized helicopters. Either way is fine, except you should be careful not to change the weights of the blades and not to add too much weight to them. The tail blades must be fitted into the tail rotor blade holders so that when the tail shaft rotates clockwise (viewed from the left hand side of the helilead. The rounded side of the blades will also be facing you. The ball connection of each plastic blade holder will be on the trailing edge side of the tail rotor blades.

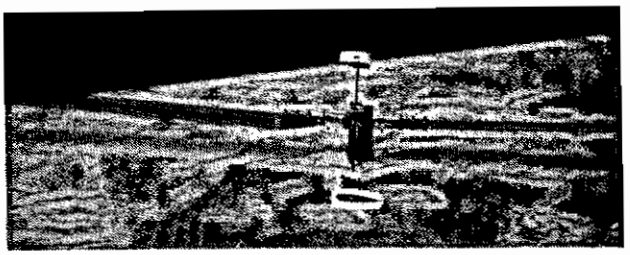
Main Rotor Blades

The main rotor blades are fully finished unless you wish to taper them in the same way as the tail rotor blades. They are done in a similar manner by noting that the main rotor blade system rotates clockwise (viewed from the top) and the leading edge of the blade should be facing the direction of rotation and the rounded surface should face upwards. Use this to determine which side of the blade is tapered off at the trailing edge. The blades should be covered with the vinyl film provided or you could go to the local hardware store and buy vinyl film of your own color choice. Before applying the vinyl it is advisable to lightly spray colored dope on to the first two or three inches of the blades on the inside and also the section of the blade at the tip. This will prevent any oil or grease from soaking into the wood. Now to cover the blades, strip the paper backing from the vinyl covering and hold one blade up with your finger and thumb in front of you, with the flat edge of the blade facing you and the trailing (or thin) edge to the right. The mounting portion of the blade (with the three screw holes) will be at the bottom. Now, with the sticky part of the covering facing away from you, overlap the trailing edge of the blade facing you by about 1/2", attaching it at the top or end of the blade first, and then carefully let the blade covering stick to the trailing edge underneath until you have the full length fully covered by 1/2" of vinyl. Smooth down carefully with the fingers and then you can take the blade horizontally in your hand and fold the covering over the top surface of the blade, making sure there is a sharp crease at the trailing edge. If handled gently and carefully covering a blade with vinyl covering is very easy. It can be made difficult if the covering is pulled hard in some places and not in others. So be very careful to just gently smooth the covering over the blade rather than pull it too tightly. After the top surface is covered, the covering can be wrapped around the leading edge carefully and pulled underneath the blade again until it overlaps the first 1/2" joint that we made at the very beginning. The blade will now be covered with the vinyl and the same can be done for the second blade. Balancing the blades will be done on the rotor head itself.



Now take the four blade straps from the hardware bag, together with six 3x16mm socket head screws and six 3mm lock nuts. Fit the blade straps, as shown in the photographs, with the heads of the screws underneath the blades and the 3mm lock nuts on top. By using a steel straight edge, make sure that the blade straps are fitted so that they are exactly parallel to the leading or trailing edge of the blade. After this is accomplished, carefully tighten all three nuts on both blades. (Don't squash the wood!) Now the blades can be fitted to the rotor head. Take the temporarily fitted 3x16mm socket head screws out of the seesaw and using them, fit the blades on to each end of the seesaw by the end holes of the blade straps. One one blade, fit the small metal bracket which has a 3mm clearance hole on one side and a 70 thous. hole on the vertical side. The photograph will show you the way in which the bracket is mounted. Do not fit the teeter wire yet. Now fit both 3mm lock nuts and bolts so that there is reasonable friction at the joint. Then straighten the blades so that they are at 180 degrees to the flybar.

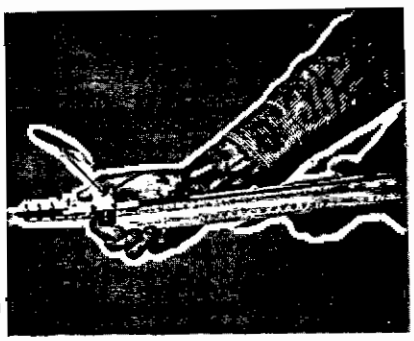
Now rest the flybar onto two parallel sharp edges so that the whole blade system can teeter on the flybar. One blade will probably fall and this is the heavy blade. Now cut a strip of colored Monocote tape, about 3/4" wide and 2 1/2" long. Fold this over the blade near the tip and secure down firmly. This will provide some extra weight for the light blade and also provide us with recognition of which blade is high, or low, when we come to "track" the the light blade, then another small strip of vinyl may be fixed underneath the flat surface of the blade, along its length, until the necessary balance is achieved. This particular part of blade finishing is very important and, if done carefully, will help to avoid vibration and shaking of the helicopter later on. The fully assembled rotor head can now be fitted on to the main shaft, using the 3x16mm screw and 3mm nut which were temporarily fitted into the top hole of the main shaft. Make sure that this nut is tightened securely.

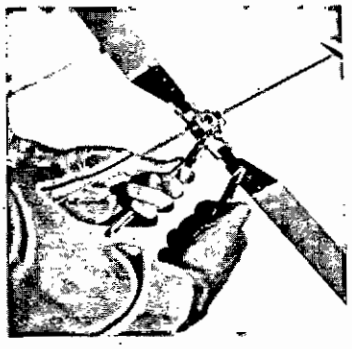


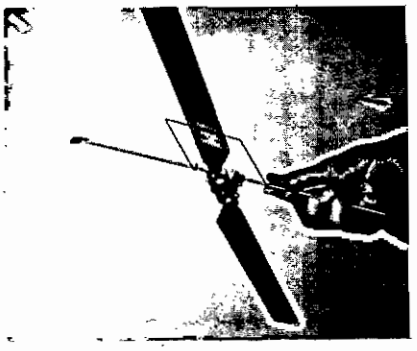
Before we can flight test our helicopter, there are two initial static settings which must be made to the rotor blade system. The first is the incidence of the main blades.

The "Cricket" operates best at an angle of about 4 degrees, measured from the flat underside of the blades. This may be readjusted slightly during flight testing. It is normal to use some form of gauge to line-up the angle of the blades, looking end on, with the plane of the flybar. We have developed an idea for "Cricket" which works well and we suggest you try this method for setting your blade angles.

The incidence gauge is made of a piece of 1/16" steel welding wire, about 14" long. Each end is bent into a half circle, or small hook, which fits snugly over the flybar. The wire is then formed into an open sided rectangle with two 4" long sides and one long end. The angle between the two side legs is set to 4 degrees. To do this, place the gauge on a flat surface with the hook ends facing up and away from you. Twist the right hand leg up until it is 9/32" higher than the other leg. This will form an angle between the two legs of approximately 4 degrees. Now take this piece of wire, hook it on to the flybar under the blade and rotate upwards to just touch the bottom surface of the blade. This will give an instant indication of whether the blade angle needs to be increased or decreased. Note that the wire should only just lightly touch the under surface of the blade, otherwise the angle measured may be incorrect.







In order to set the angle of 3 1/2 degrees, the blade straps must be twisted between the end of the blade and the seesaw. This can be done by using two 'Crescent' wrenches, holding one across the seesaw and the other one just inside the third screw holding the blade straps to the blade. Using the Crescent wrenches as levers, twist the blade until it is set to the right positive incidence angle of 3 1/2". Check this setting by using the wire incidence gauge.

The blades should also be checked that they have the correct coning angle. This angle has been set into the seesaw, and, provided that the blades project out straight from their respective sides of the seesaw, the coning angle will be correct. To check on this, hold a ruler or other straight edge under the seesaw. The blade undersurface should be parallel and just touch this edge.

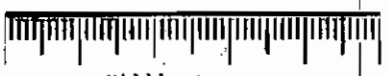
The starting and setting-up procedures and flying instructions are given in a separate brochure with the "Cricket" kit.

The fully assembled rotor head is now fitted on to the main shaft, using the 3x12mm screw and 3mm nut which were temporarily fitted into the top hole of the main shaft. Make sure that this nut is tightened securely. Also fit the .055" dia. teter wire and tighten the 3x5mm screw which retains it (L). (See photographs and assembly drawing for guidance.)

STAGE 7 - CABIN ASSEMBLY

Open bag 7 which contains the five pre-cut plywood parts needed to form the cabin radio mounting tray assembly. From the hardware bag take the following:

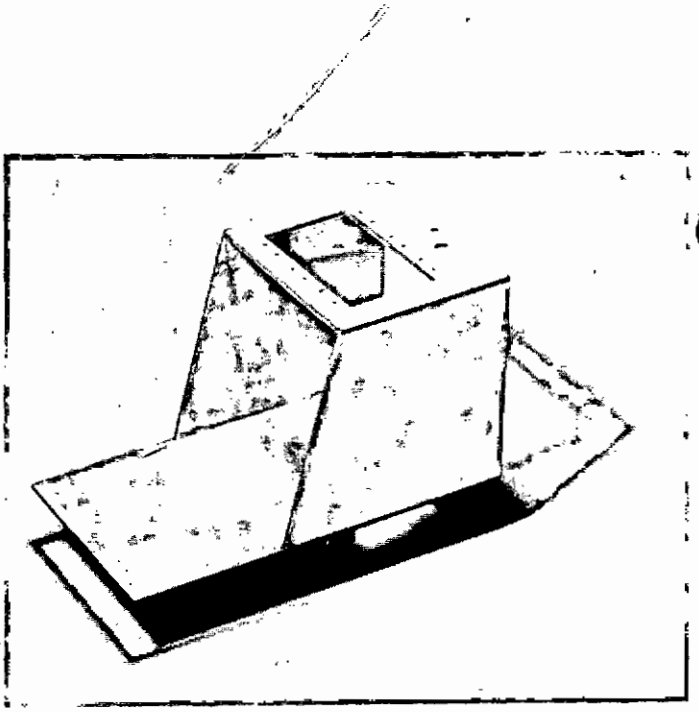
1 - small right angled metal bracket
(with two 3mm holes)
1 - 3x25mm Pan Head Screw
2 - 3mm Washers
3 - 3mm Lock Nuts
2 - 3x10mm Pan Head Screws
2 - #2x1/4" 'PK' Screws

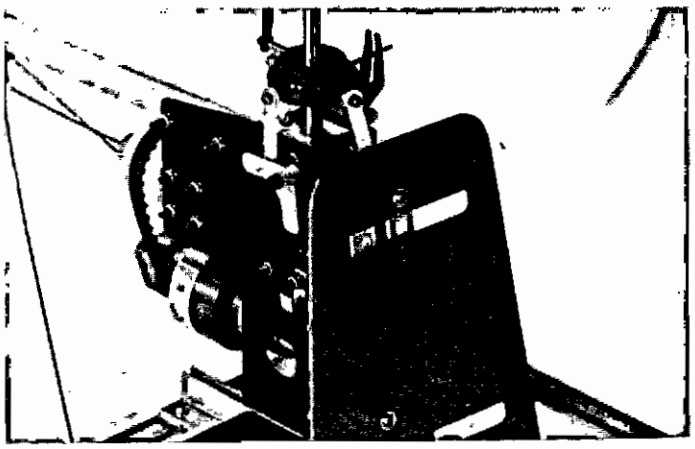


Glue together the four plywood pieces to form the radio mounting tray. We use a cyandacrylate glue to 'tack' the parts, and then a generous fillet of 'five minute' epoxy to strengthen the joint. After the glue dries, paint this unit and the cabin back plate with paint of your choice (we just use a spray dope - black for the backplate and white for the radio trays).

Fit the cabin backplate, as shown, using the two #2x1/4" PK screws. Now fit the radio tray to the helicopter using the 3x25mm pan head screw with two 3mm washers. One washer goes under the head of the screw, above the lower radio tray plywood piece, and the other washer is fitted on to the screw after it is passed through the slot between the two horizontal angle pieces. A 3mm lock nut then secures the whole unit to the lower horizontal angle pieces. The small metal bracket is now used to secure the upper radio tray to the vertical angle pieces. The two 3x10mm pan head screws and two 3mm lock nuts secure the bracket to the left hand vertical angle (also passing through the plywood backplate), and to the hole in the upper plywood tray. See the general arrangement drawing and the photographs for details.

The cabin is now ready for the radio installation. Note that the radio compartment is shaped so that a 6" to 8" high miniature pilot can be readily fitted into "Cricket". A plastic seat and console is also available as an option to further enhance the cabin interior.





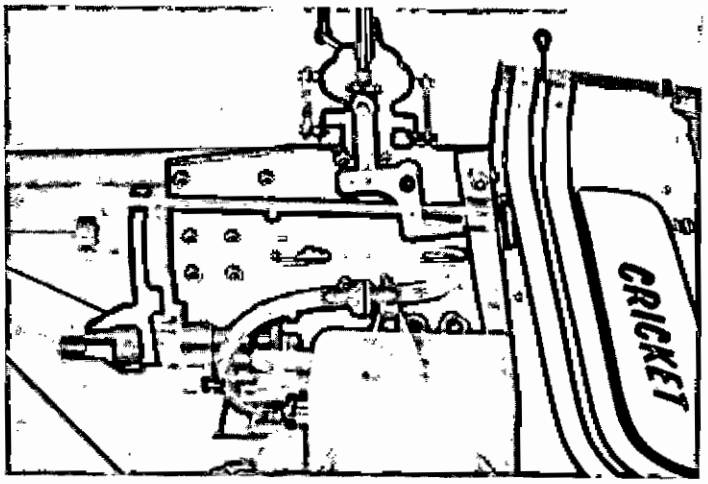
RADIO AND CONTROLS INSTALLATION

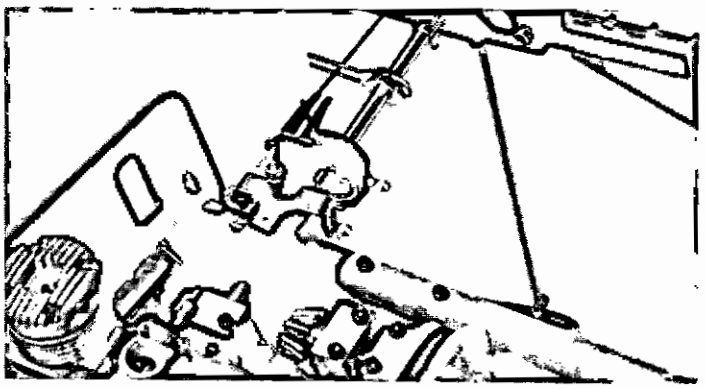
General

Before we can proceed on the installation of the controls, there are two control levers to be fitted. The first is the plastic L-lever, used for roll control. This is installed as follows. First, from the hardware bag, take the following items:

1 - 3x25mm Socket Head Screw
2 - 3mm Lock Nuts
1 - 5x32" x .28" Brass Spacer
1 - 5x32" x .40" Brass Spacer
2 - 3mm Washers

3 - 2x10mm Pan Head Screws
6 - 2mm Nuts





Take the L-lever and cut a small piece off one arm so that only two 1/16" holes are left, instead of three. This must be done so that the lever will clear the main gear. Fit a 5mm ball to the inner hole of the longer arm by means of a 2x10mm pan head screw and two 2mm nuts. This must be done exactly as shown.

Now take a 3x25mm socket head screw and fit the short (.28" long) brass sleeve up to the head of the screw. Slide the L-lever on to the sleeve so that the side of the L-lever with the 5mm ball faces away from the screw head. Fit a 3mm washer and the longer (.40" long) brass sleeve on to the screw, and then fit the whole assembly on to the right hand top side of the main plate. The hole to be used is located just ahead of the main shaft top bearing block. See photograph.

The second control lever to be fitted is the T-lever, which is used for pitch control of the swashplate. This lever is complete except for the fitting of two 5mm balls. These balls are each placed on a 2x10mm pan head screw and locked in place with a 2mm nut (L). The screw is then fitted into the small holes on the sides of the lever with the screw head and ball facing outwards. A 2mm nut is then fitted to the screw projecting through to the inside of the T-lever and locked up tightly (L). Make sure that these two balls are very firmly fitted to the T-lever since a failure at this point can result in a control failure to the helicopter.

Now slide the completed lever on to the 3mm screw which was previously fitted to the center hole of the swashplate locating bracket. Fit a 3mm lock nut on to the screw to retain the T-lever and tighten so that the lever can move freely but the 'free play' is kept to a minimum.

The swashplate is now connected to the three balls on the T-lever and L-lever, using the three double ended ball links. This arrangement is much like a three legged stool and provides a very tight control for the helicopter which greatly improves its flight performance. These three double ball joints 'support' the swashplate from the T-lever and L-lever. Any movement now of either lever will result in a direct response of the swashplate. Check, at this stage, that the 'O' ring is still in the correct location in the groove inside the swashplate inner ring.

The 2mm x 7cm control rod (threaded both ends) should be fitted with a ball joint with ball at each end. This link fits between the flybar control arm and the end of the upper swashplate output arm. The length should be adjusted so that the paddles are exactly parallel to the top surface of the swashplate. The carrier should be adjusted so that it is vertical when the main shaft is 'driven'. The vertical position of the carrier can be determined from the one-half scale side view of "Cricket".

RADIO AND CONTROLS INSTALLATION

General

Your "Cricket" should now be completed to the stage where you can commence fitting the radio installation.

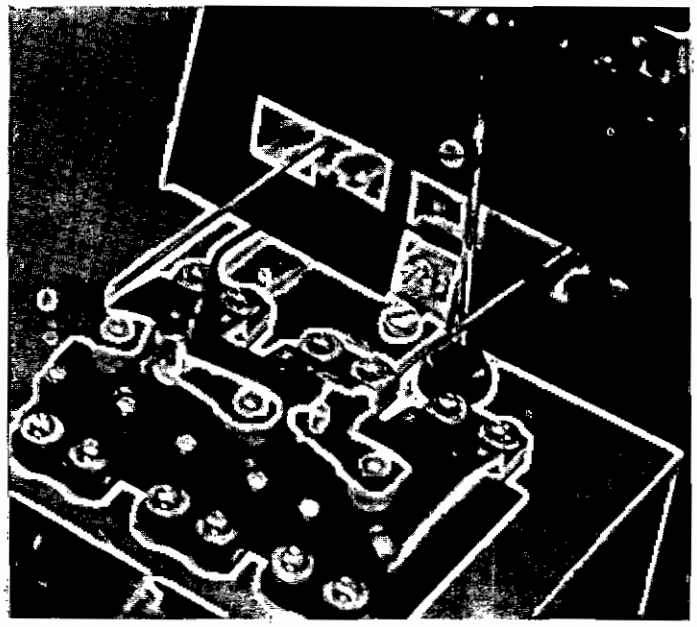
Servos

Servos larger than 'micros' may be used except that the weight of "Cricket" should be kept as low as possible. You will find the width of the "Cricket" is sufficient for most of the small 'mini' servos, also. To accommodate the extra length, you will need to cut the rear edge of the servo openings to fit the serovs. The servo-controls schematic drawing will give you a good idea of where each servo connects in the control system of the helicopter and the direction that it must move relative to movement of the transmitter controls. The throttle servo can be either a standard or a reverse type by installing the servo lever either on the right or left hand side of the servo.

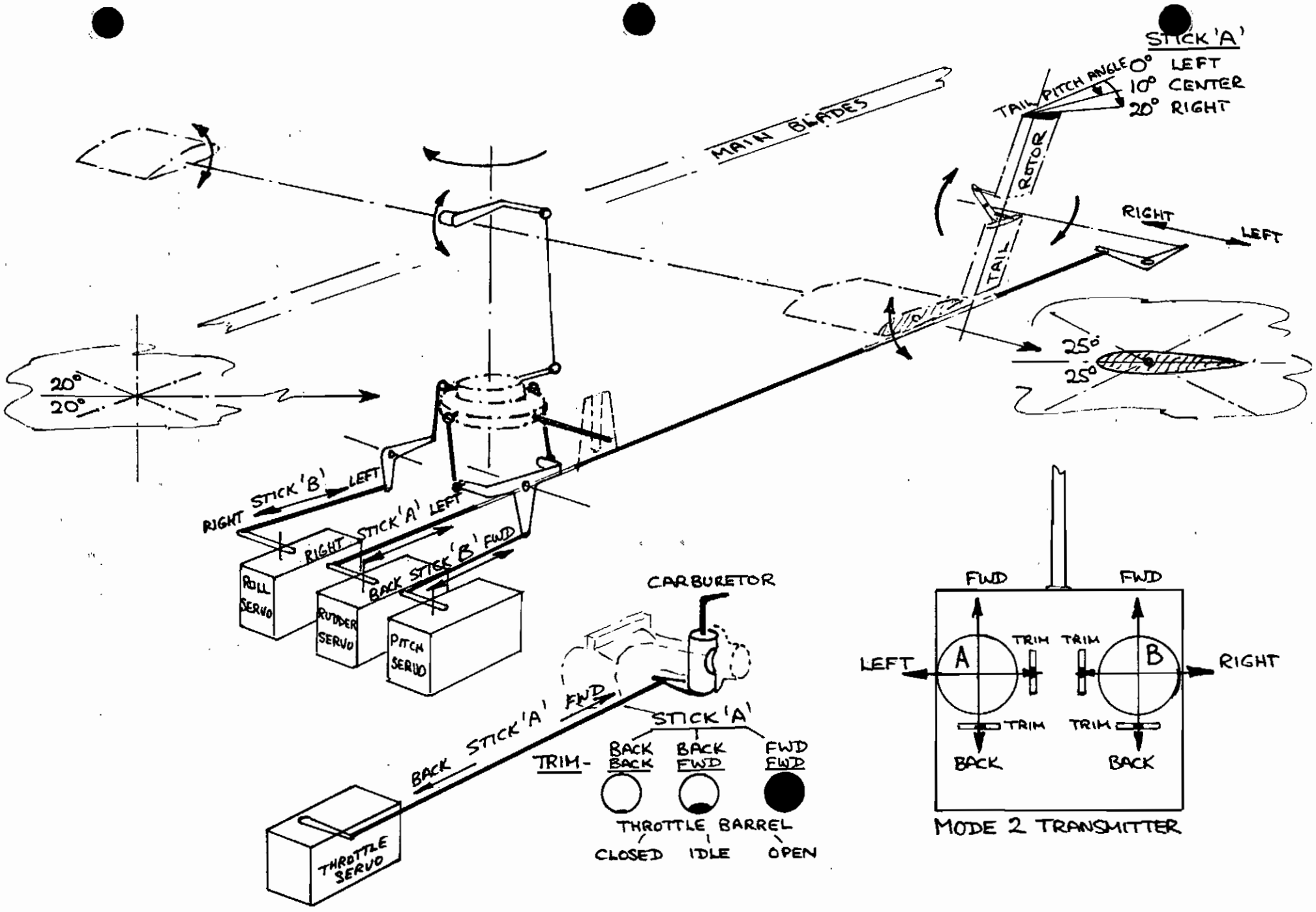
Now on the upper servo tray, the right hand servo (looking in the direction of flight) controls the right and left roll of the helicopter, the center servo controls the tail rotor pitch (yaw), and the left hand servo controls the pitch forward or backwards. It is important, with at least two of these servos, which side the servo arm is fitted and, hence, the rotation sense of the servos must be appropriate. Note, however, that normal and reverse servos can be swapped over to provide the right rotations since the throttle and pitch servos can have the arm fitted on either side.

Control Linkages

The 1/16" dia. threaded steel rods are used for pitch, roll and throttle. These are each fitted with a mini-clevis on the threaded end. The other end is bent up at a right angle to suit your particular installation and then retained in the servo arm by a 'Snap R Keeper'. The position of the clevis on the rod should be set, initially, so that the rod end just protrudes through on the clevis pin side by about 1/16", thus allowing an adjustment of plus or minus 1/ 8" on the clevis without the clevis becoming dangerously short of threads to grip. In this position, and with the servos both at neutral, the swashplate should be horizontal fore and aft and tilted slightly to the right in roll. Again, make sure that all the linkages are free and are not impeded in any way by fouling the structure or by any unnecessary friction at the servo end connector. The center (yaw) servo is connected by the 25 1/2" steel wire provided. The wire is first fed through



the long plastic tube. It is connected at the rear end by bending at a right angle and fitting a 'Snap-R-Keeper' after the right angle bend has been inserted in the center hole of the tail gearbox lever. Note that this wire must also be given a slight set a few inches along its length in order that it will run parallel to the tail boom all the way up to the point where it enters the cabin. Now fit the servo pushrod connector provided into the center hole of your servo arm, and fit the cabin end of the tail rotor control rod into this fitting. You will note that the front end of this rod will also need to be set at a slight angle in order to connect with the servo arm without bending or straining the rod. The installation should be adjusted so that the servo is at zero when the tail rotor control lever is in its mid position. The outer plastic tubing should be strapped to the tail boom in two places by some 1/4" wide plastic tape. Some silicone rubber compound can be put around the joint where the tubing enters the cabin plywood backplate to retain the tubing at this point also. Make sure, when you tape the plastic tubing to the tail boom, that you do not impede the free movement of the rod. This should be checked by moving the rod from the front end before it is finally secured to the servo, to be sure that there is not any unnecessary or undue friction in this very important control linkage.



SERVO-CONTROLS SET-UP FOR "CRICKET" R/C HELICOPTER

When installing the throttle servo don't forget that moving the throttle stick up the box (or forward) must result in the engine carburettor barrel opening. You will see in the schematic that the throttle barrel should be completely closed when the throttle lever is zero and the throttle trim is zero. Moving the throttle trim to full position should produce a small opening which should result in a fast idle of the engine. This part of the control system is particularly important since it is very necessary that the engine power be thoroughly under control of the pilot and that the engine may be stopped remotely, if necessary, by closing both the throttle lever and throttle trim. Make sure the linkage between the servo and the carburettor is completely free and easy to move. Any excessive friction will result in a drain on the flight batteries which could cause a premature failure of the radio in flight. This point, of course relates to all the servo channels.

Receiver and Battery

Your receiver may be packed loosely in foam and inserted in the cabin beside the throttle servo. The battery pack should be fitted as far forward as possible. You may need to cut a small piece of plywood to fit your battery and secure the plywood to the lower side of the lower servo frame with 5 minute epoxy. You may then rubber band your battery underneath, or on top of, the new piece of plywood. A couple of small PK screws securing the two pieces of plywood together is also useful to ensure that the plywood stays in place if you ever have a hard landing!

Switch

The final item of the radio installation is the radio switch. As you can see from the photographs, we used one of the available plastic switch holders (DuBro, Rocket City, etc.) which will then permit the radio switch to be mounted to the rear of the top servo tray. The radio can then be switched on and off through a hole in the top of the canopy. This provides a particularly nice and neat installation since the whole radio tray and radio can now be removed from the helicopter by just releasing two screws.

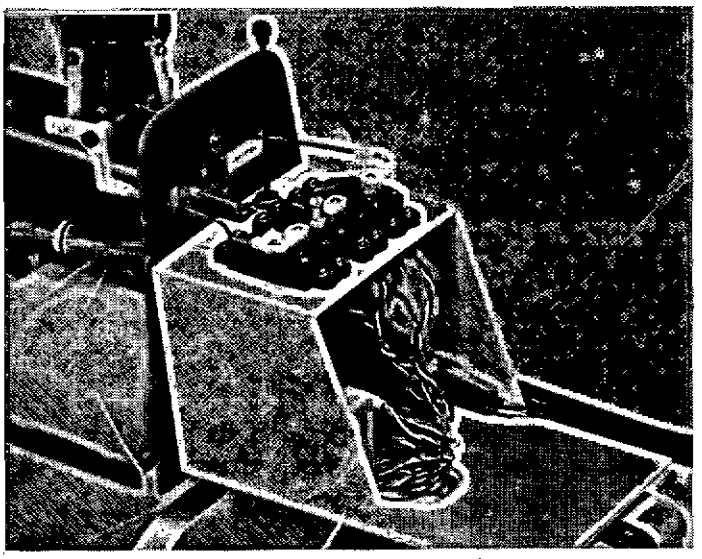
Final Adjustments

Again, we emphasize the need to be sure that all the controls move freely and easily and to check this by moving them with your fingers at the servo end before the final connection to the servos. Also check thoroughly that the directions of movement are correct by again referring to the schematic diagram for this information. The full range of movements are shown in the servo schematic diagram. For the beginner, the swashplate should be set up to move approximately plus or minus 15 degrees in roll, and plus or minus 12 degrees in pitch. The tail rotor control should be initially set to move through just a little less than the full range permitted by the slot in the tail rotor gearbox. This movement can be reduced if the beginner finds the tail too sensitive. For the expert, obviously greater movement to the swashplate can be used. However, make sure that the swashplate locating pin cannot come out of the slot in the swashplate bracket when used with these large movements.

We allow our antenna to just dangle out of the side of the servo cab, but there are many other arrangements which can be used, provided that the antenna is not run in close contact with the metal frame for any significant portion of its length.

Carry out a final check of the radio when the helicopter is complete and all parts, such as the cabin, fuel tubing, etc., are fitted.

Finally, don't forget to recharge your batteries before attempting to fly. You have probably used up more capacity than you think in going through the setting-up procedures.



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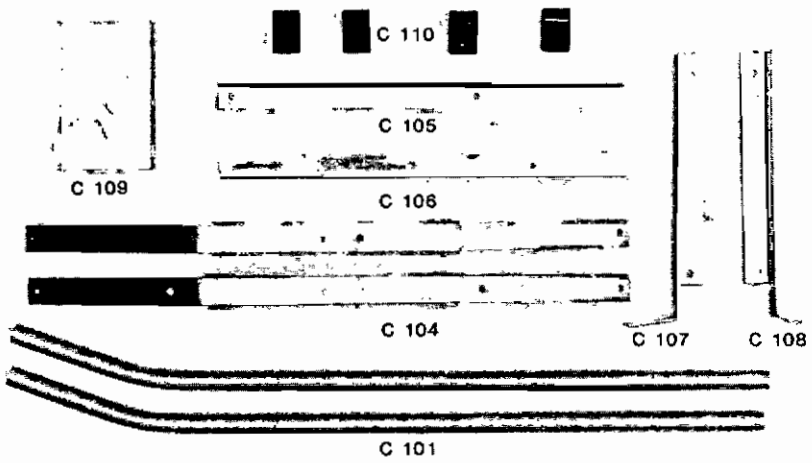

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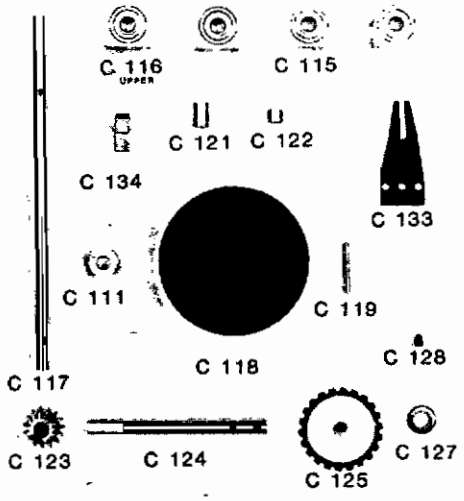

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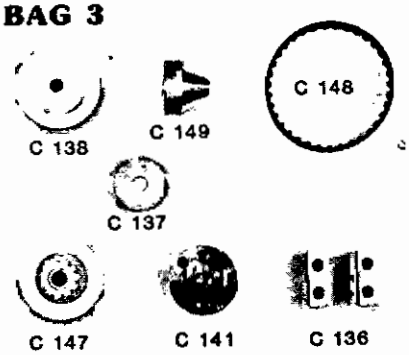

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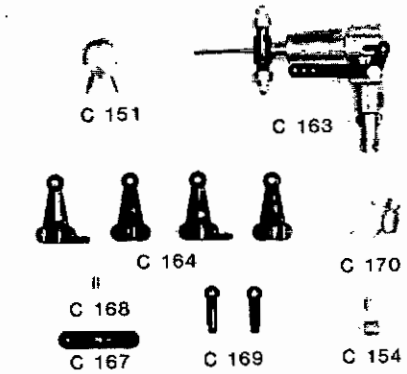

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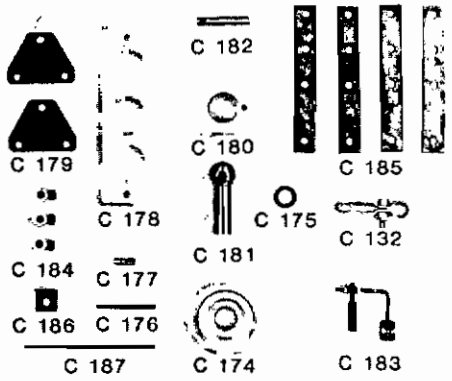

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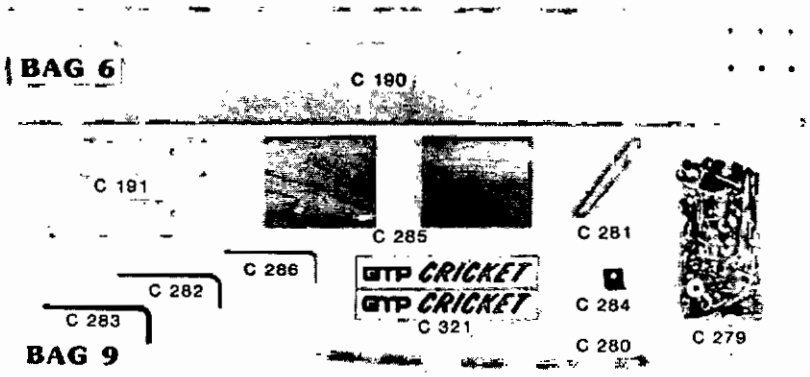

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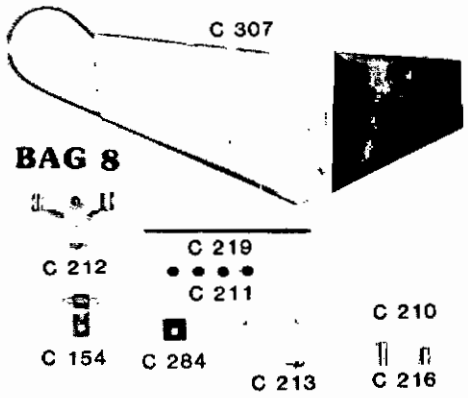
BAG 8



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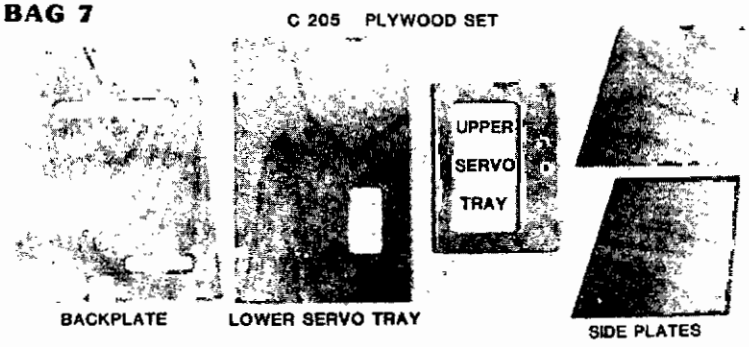

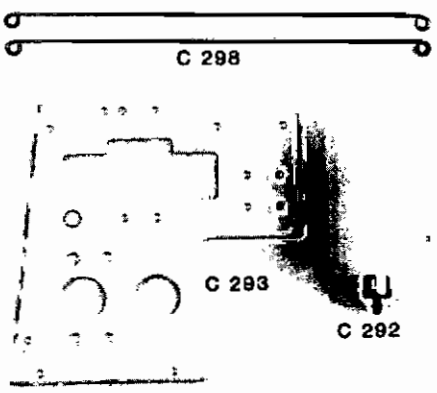

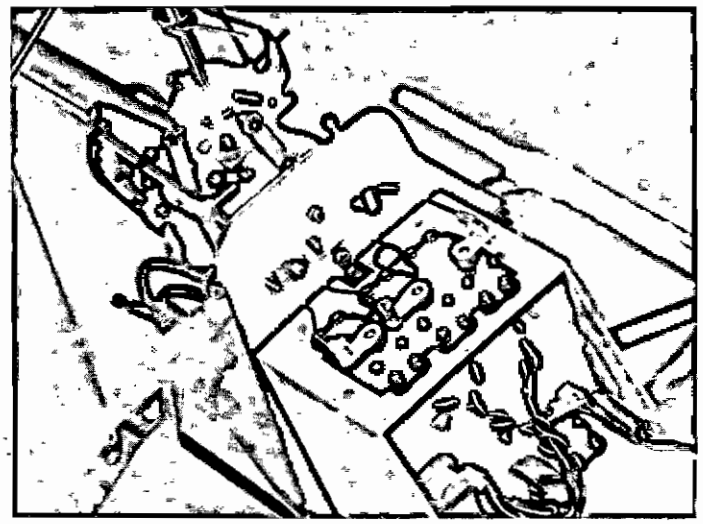

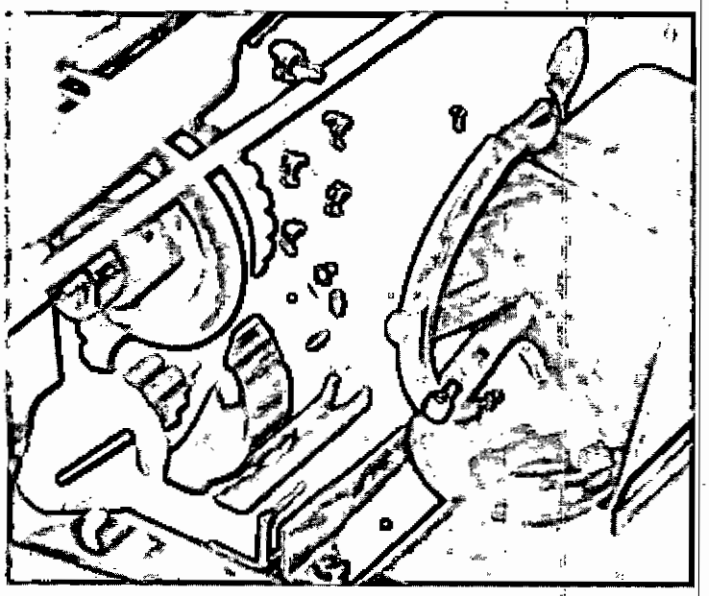

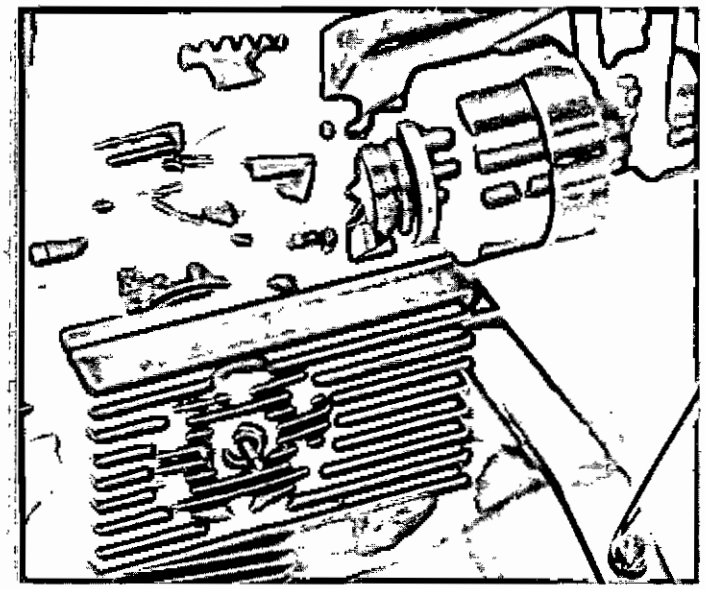

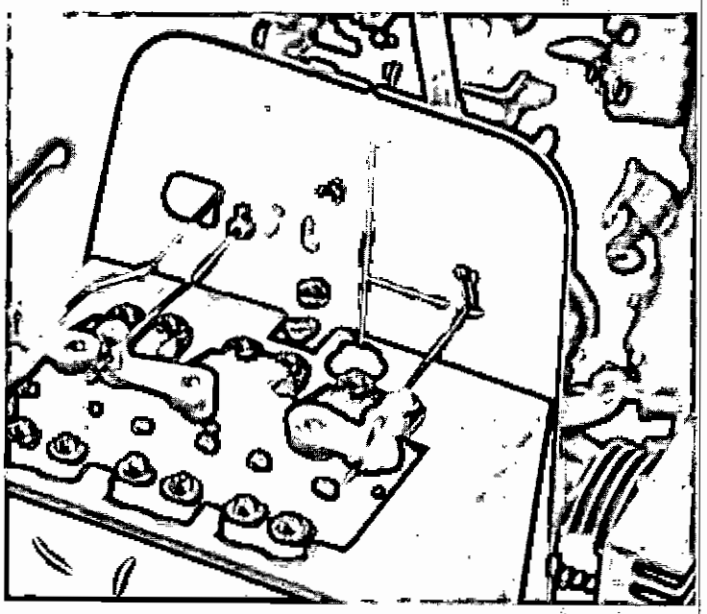

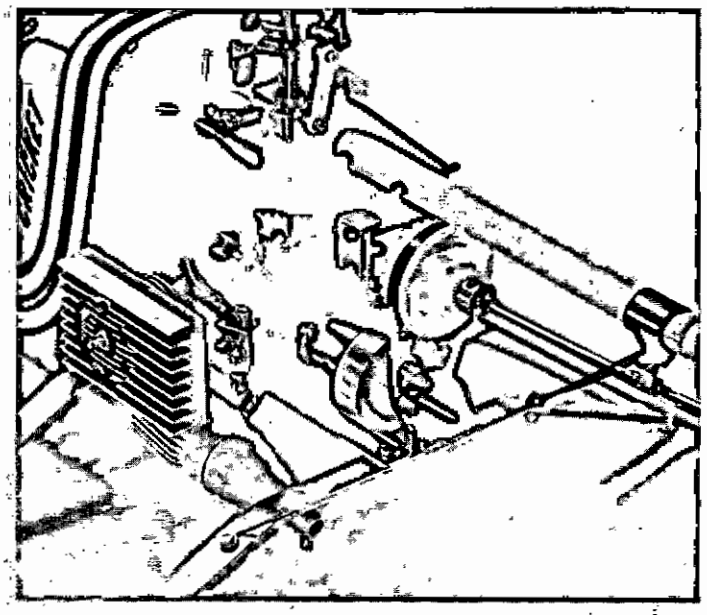

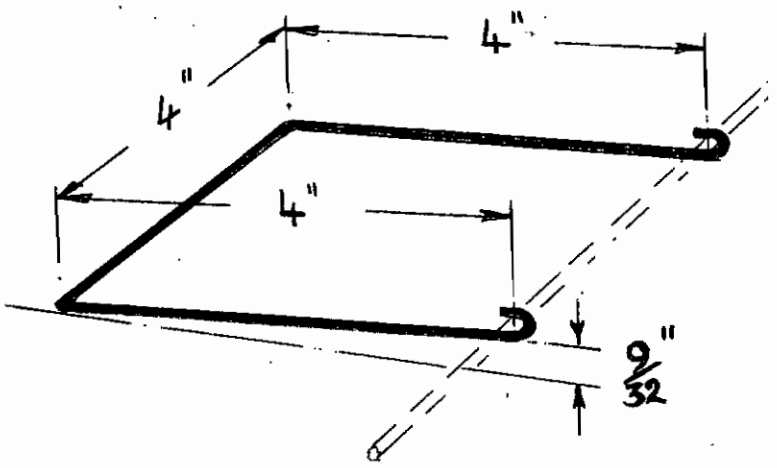

MAIN ROTOR BLADE INCIDENCE GAUGE

Lubrication

The ball bearings used in "Cricket" are already lubricated and so is the tail gearbox. A light machine oil can be used on the ball joints and linkages and, especially, on all rotating or sliding metal parts such as in the rotor head. This item must be kept very free at all times. The nylon and steel gears must not be lubricated.

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