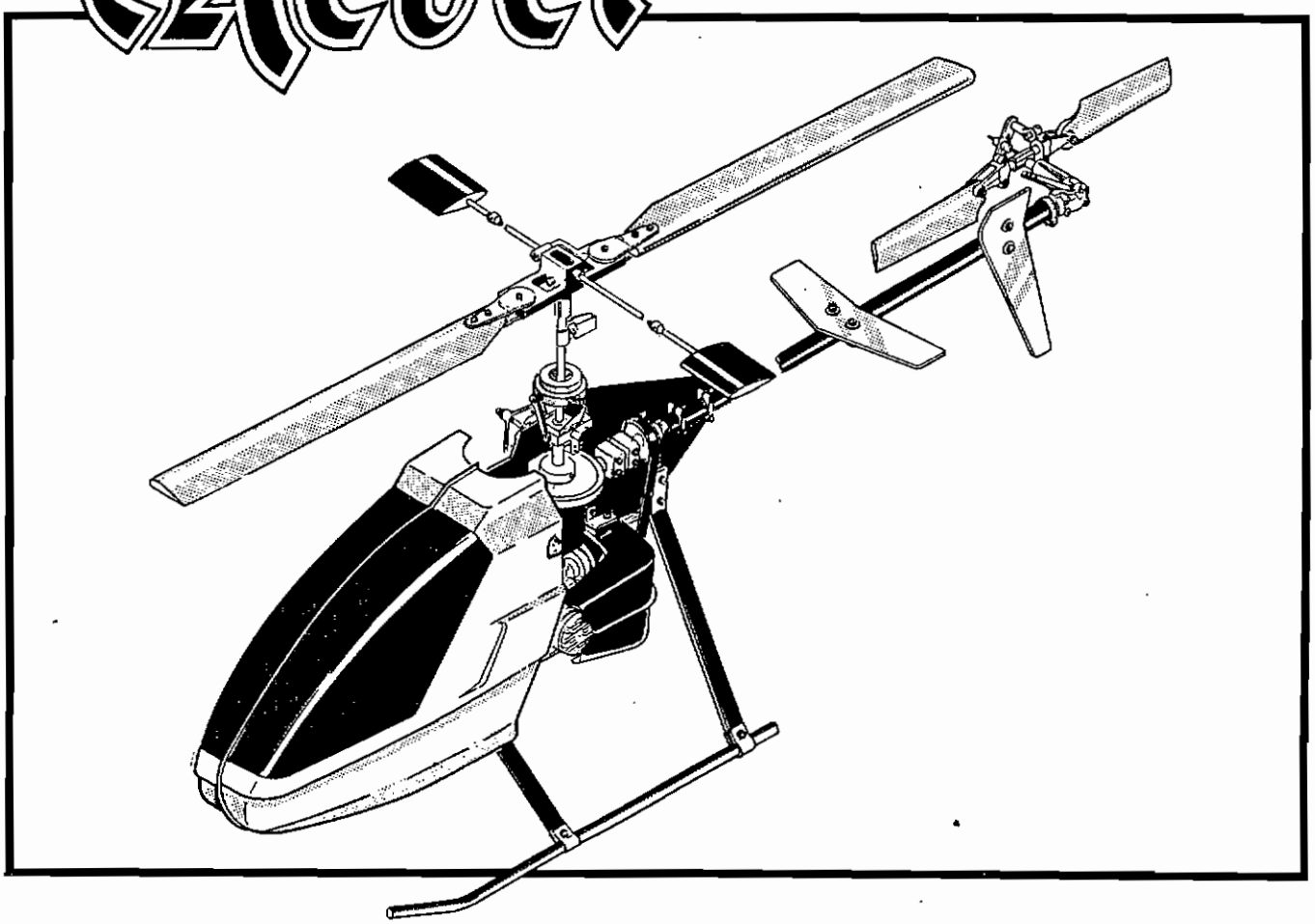
8/89

Rebel



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BASIC ASSEMBLY MANUAL

GORHAM MODEL PRODUCTS, INC.,

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INTRODUCTION

The Rebel is an exciting new 40/45 powered R/C entry level helicopter by GMP added to its ever increasing range of R/C helicopters. It was designed to give the interested beginner an opportunity to fly R/C helicopters for a fraction of the entry costs associated with todays more complex helicopters without any sacrifice in quality, reliability or stability. The Rebel is also a perfect 'fun machine' for the expert to 'tool around the sky' with or take along on family picnics. Special features include extremely simple assembly, low parts count, rugged construction, and the use of 'standard' airplane radios and engines.

TECHNICAL FEATURES

Engine size:	.40-.45cu.-in. (6.5-7.5 cc)
Main Rotor Span:	42" (1068 mm)
Tail Rotor Span:	10" (254 mm)
Main Rotor Speed (Hover):	1600-1700 rpm
Height:	16.5" (419 mm)
Length:	40.5" (1029 mm)
Weight:	with gyro, 1000 ma battery pack, 45 engine, and 5.5 - 6.5 lbs. (2.6-3.0 kgs)
Radio:	4 channel
Servos:	4 servos
Gyro:	Not necessary but speeds up learning process.

UNSURPASSED GMP QUALITY

GMP R/C helicopters have always been world-renowned for their completeness and quality. Although the Rebel is a simple, low parts count helicopter, it maintains this tradition. High quality ball-bearings are utilized in every key area and the main chassis is constructed of 1/8" (3mm) thick aircraft grade aluminum alloy for longer life and durability. The Rebel uses metric nuts and bolts, as do all GMP models. These are selected by nearly all the world's designers as being superior for small mechanisms, and so are rapidly becoming a world standard. The metric hardware is lighter, since it has smaller bolt heads and nuts, and its use enables the whole helicopter design to be lighter and more compact. The threads are finer and, hence, each bolt provides more tensile strength for a given diameter. 90% of the world's RC helicopters now use metric hardware. The GMP Rebel's metric system is a world standard one and is interchangeable with the GMP Cricket, Competitor, Cobra, Legend, and nearly all Japanese and European RC helicopters.

NEW ONE-PIECE ROTOR HEAD

A special new feature of the Rebel is the hi-tech composite rotor head. After much designing, experimenting, and flight testing, GMP has developed a unique rotor head that offers the utmost in simplicity and performance. The new rotor head consists of a one-piece nylon center unit with a dual ball-bearing supported hub. Hiller flybar control pivots in the nylon center unit. Pre- bent blade holders automatically adjust the main blade pitch to the optimum setting. Hence, the Rebel is very easy to set-up as it has the fewest parts count of any rotor head on the market, has lots of inherent static stability while maintaining a very adequate aerobatic capability.

MAIN ROTOR BLADES

The main rotor blades are specifically designed and matched to maximize the flight performance of your Rebel. A combination of unique airfoil and blade chord dimensions has produced a flight response that is very conducive to learning how to fly quickly with little or no damage to your helicopter. Cyclic control is soft, yet responsive. Altitude control, normally less effective in other fixed pitch helicopters, is much improved as the Rebel climbs and descends with ease and precision. This improved altitude control is a result of extensive research and testing leading to a simple yet very effective rotor blade and head design.

STARTING SYSTEM

The standard starting system of the Rebel is the cone start now demanded by descriminating modelers world wide. This greatly eases the starting process and eliminates any problems which can arise when starting with a belt. With the Rebel, however, GMP has developed this system even further to accommodate the airplane fliers. A special adapter for your electric starter is no longer needed as the Rebel was designed for use with the standard 'airplane' starter cone fitted to most airplane electric starters. However, the rubber insert may need to be reversed so the smaller opening engages the starting cone.

CLUTCH DESIGN

The clutch is the classic GMP standard one-piece design machined from steel, not plastic. This provides superior and reliable perfor-

mance. The GMP clutch unit is many times more expensive to manufacture than other plastic and some two-piece metal clutches available today, but it gives smoother engagement and drive performance and it virtually lasts "forever". The clutch bell is fitted with a special lining which is individually factory fitted for your particular kit to provide correct engagement and reliable operating performance.

STANDARD, INEXPENSIVE AIRPLANE EQUIPMENT

The Rebel is aimed towards the person who is interested in trying R/C helicopters but who cannot justify the expense of buying the special helicopter radios and engines needed for todays more complex helicopters. Therefore, the Rebel was designed around the ever popular 40-45 size airplane engines and inexpensive 4 channel radios that many people already have. This dramatically reduces the entry cost to a level where many more people can "try the RC helicopter challenge."

ENGINE INSTALLATION

The engine of the Rebel faces the side of the helicopter to facilitate quick glow plug changes. It is mounted to the main frame via a separate plate that permits easy engine access and removal. The headaches sometimes associated with engine change or removal for servicing are greatly simplified with the GMP Rebel.

TAIL ROTOR MECHANICS

The Rebel uses the tried and proven Cobra/Competitor tail rotor gearbox. This gearbox comes to you factory assembled complete with greased gears and bearings. Ball bearing blade holders complete the assembly producing a tailrotor system that provides very smooth control response and, with regular lubrication, virtually unlimited life.

BUILDING

BUILDING PROCEDURES

The Rebel can be built very fast, even by the average builder. However, for the modeler who has not built this type of helicopter before, we strongly recommend fully reading the building instructions one time at least before commencing construction. It is extremely important that all of the requirements of the designer are met in terms of adjustments of the controls and assembly of the mechanical items. Sloppy building and any mistakes in setting-up the controls of an RC helicopter will show up in flight characteristics, reliability and even safety much more than with a model plane. So do be sure that you go through the building sequence slowly and by stages and commence work only after you have read the full instructions at least once. Precision is the "name of the game." The tools that you will need include:

- pair of scissor
- small screwdrivers (flat and phillips)
- allen keys (provided in kit)
- 7/32" or 3 mm nut driver (can be purchased from local radio parts store)
- pair of pliers
- modelling knife
- suitable socket wrench to tighten the engine nut of your selected engine

You will also need a small tube or bottle of any of the popular "10 second" Cyanoacrylate glues, some fine 200 grit sandpaper, paint, masking tape, a tube of clear silicone sealer and some epoxy glue.

The construction of Rebel does not require any extra machining, filing or sanding and so assembly of your kit will not necessitate a work bench. However, do be sure to cover your work surface with thick (very) paper or cloth material since the metal parts of Rebel can scratch polished table surfaces, then you will be building your future helicopter kits in the garage. One important factor in building an RC helicopter, which cannot be stressed enough, is that all nuts and threaded devices (other than 'lock' nuts) should be assembled using blue 'Loctite' or equivalent, so as to make separation of these components by vibration highly improbable. It is also important to note that there is a version of 'Loctite' used for assembling bearings which is usually a red color. This 'Loctite' will give a permanent assembly and, hence, if you use it you will find it difficult (if not impossible) to take your helicopter apart again so please don't use the red variety on parts which you wish to disassemble later. You may, however, use the red variety on parts which you do not expect to disassemble. If you cannot locate a supply of red 'Loctite', try your local auto parts or hardware store. Please also note that 'Loctite' must be used sparingly - a very small amount should be applied to the threads to be secured. It works better this way. DO NOT USE LOCTITE ON PLASTIC PARTS.

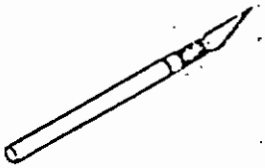
In addition to 'Loctite', one of the many varieties of Cyanocrylate (instant) glue can be used for assembling your canopy and securing some items. A tube of clear silicone is also useful in assembly of the helicopter. Wherever these items ('Loctite', 'Cyanoacrylate' or 'Silicone') are required, the text or drawings will be marked appropriately. To help in your selection of the hardware we have provided, for your convenience, a metric scale and illustrations of the various types of nuts and bolts used in the kit. Great care is taken in filling the bags with the correct quantity of parts and mistakes are rare. However, if you do find a shortage in the nuts and bolts or anything else in your kit, don't hesitate to tell your dealer or call us direct.

THE APPROPRIATE PARTS AND HARDWARE TO USE WHEN BUILDING YOUR REBEL ARE SIGNIFIED BY BAG NUMBERS AT THE BEGINNING OF EACH BUILDING STAGE. BAGE #1 INCLUDES ALL OF THE METRIC NUTS, BOLTS, AND WASHERS NEEDED FOR EACH STAGE. TO AVOID MISPLACING ANY OF THIS HARDWARE, YOU SHOULD EMPTY THE CONTENTS INTO A LARGE CONTAINER. IT MAY ALSO BE HELPFUL TO FAMILIARIZE YOURSELF WITH THE VARIOUS TYPES AND SIZES OF SCREWS, NUTS, AND WASHERS AS SHOWN ON PAGE 5 BEFORE YOU COMMENCE BUILDING.

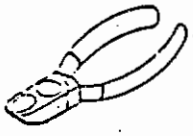
Don't forget to build under a good light. build slowly and please, please, read all the instructions very carefully. They have been written with a lot of care to try and cover every point. Even so, your comments on how we can improve our instructions are always welcome. We will continue to upgrade and try to make the Rebel instructions the finest available in the industry. Good luck in your building. Now let's commence on Stage 1.....

TOOLS FOR BUILDING AN RC HELICOPTER

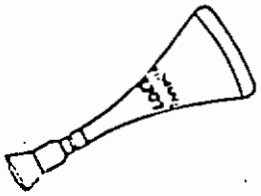
"Exacto" Knife



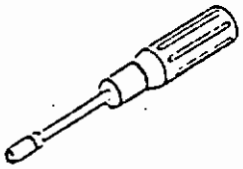
Side Cutting Pliers



Blue Loctite

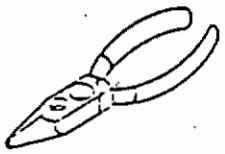


Nut Driver For 3 mm Nut



Scissors

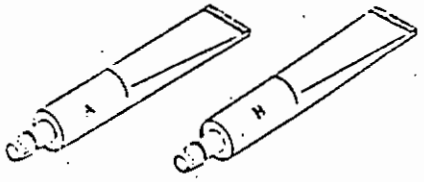
Needle Nose Pliers



Small Phillips Screw Driver

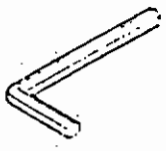
Small Standard Screw Driver

30 Minute Epoxy



Cyanoacrylate Glue (10 Second)

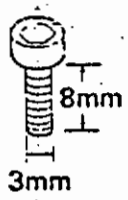
Allen Wrenches 1.5, 2.0, 2.5, 3.0 mm
(Provided In Kit)



AVAILABLE AT YOUR HOBBY STORE

TYPES AND SIZES OF HARDWARE ITEMS

SOCKET HEAD SCREW



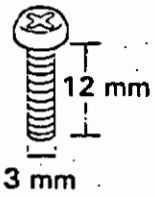
Example: 3x8 mm SH

Dia. Of Screw: 3 mm

Socket Head

Length Of Screw: 8 mm

PAN HEAD MACHINE SCREW



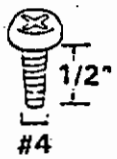
Example: 3x12 mm PH

Dia. Of Screw: 3 mm

Pan Head

Length Of Screw: 12 mm

TAPPING SCREW (P.K.)



Example: #4x1/2" P.K.

Dia. Of Screw: #4

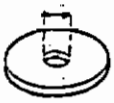
Tapping screw

Length Of Screw: 1/2"

(Two Types Are Available)

WASHER

3 mm



Example: 3 mm Oversized Washer

3 mm

Example: 3 mm Washer

LOCKNUT

3 mm

Example: 3 mm Lock Nut

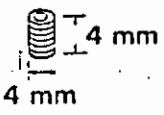
This is a nut with a nylon insert to resist loosening due to vibration.

NUT

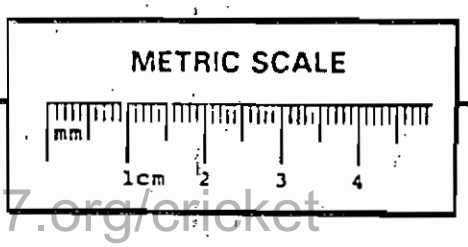
2 mm

Example: 2 mm Nut

SET SCREW

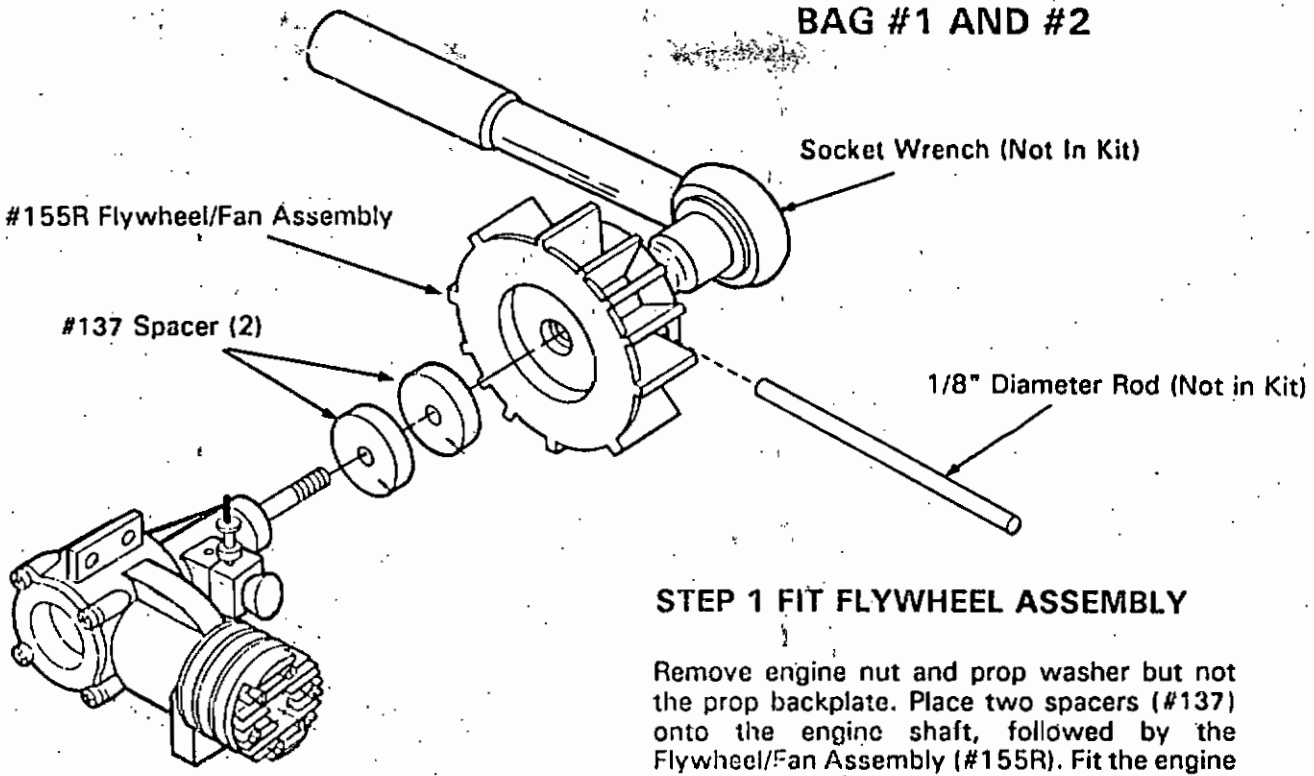


Example: 4x4 mm SS



STAGE 1 ENGINE DRIVE UNIT ASSEMBLY

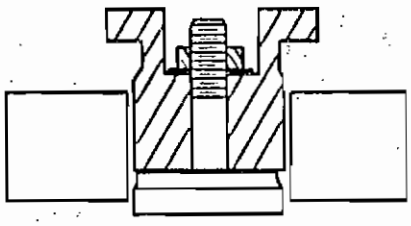
BAG #1 AND #2



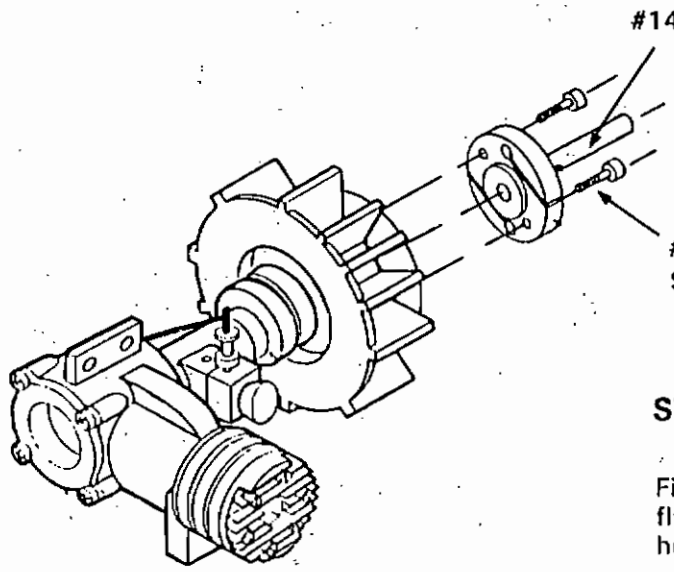
STEP 1 FIT FLYWHEEL ASSEMBLY

Remove engine nut and prop washer but not the prop backplate. Place two spacers (#137) onto the engine shaft, followed by the Flywheel/Fan Assembly (#155R). Fit the engine nut onto the shaft and tighten very firmly (to avoid loosening if the engine backfires). Hold the flywheel with a 1/8" diameter rod while tightening the engine nut. Be careful not to damage the fan blades when tightening the nut.

Since you have complete access to the engine carburetor, you should adjust the carburetor barrel stop screw so that at low throttle, the carburetor barrel is COMPLETELY closed. If you are unfamiliar with model engines, refer to the instructions included with your engine or contact your local dealer.



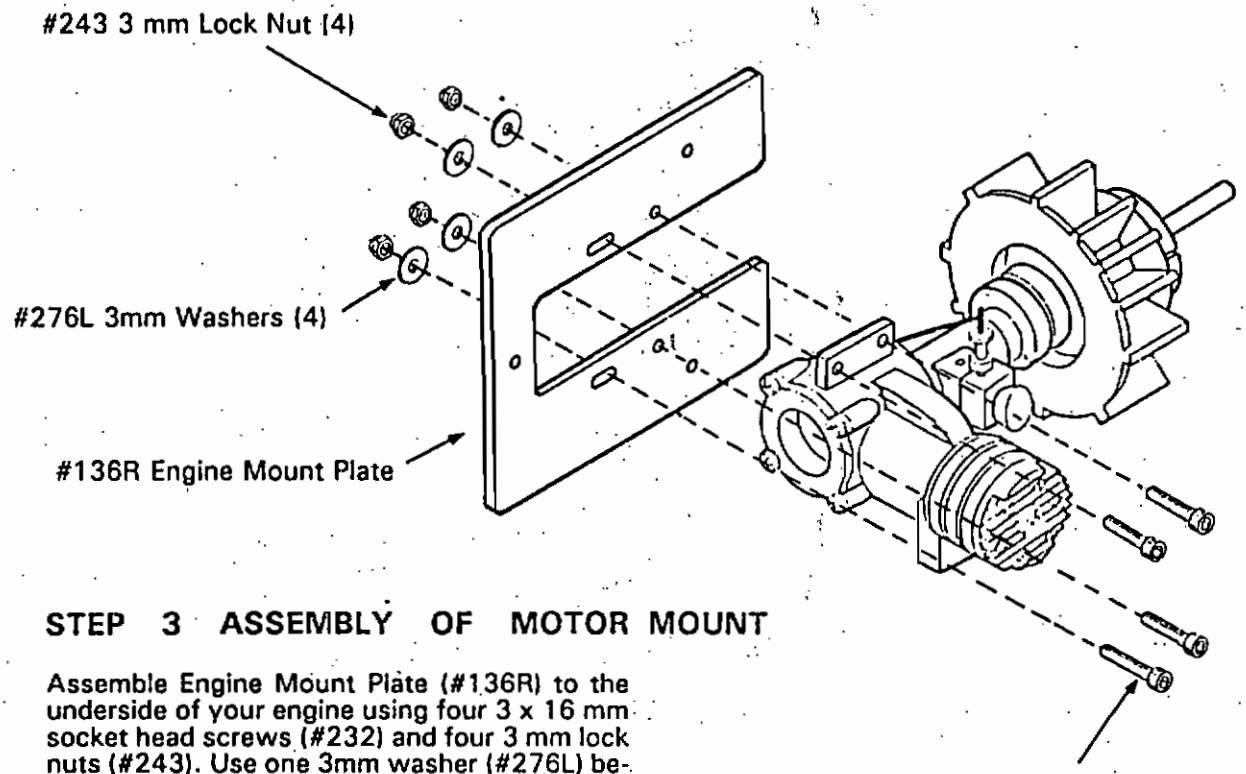
SECTION ENGINE SHAFT/FLYWHEEL



STEP 2 FIT CLUTCH ASSEMBLY

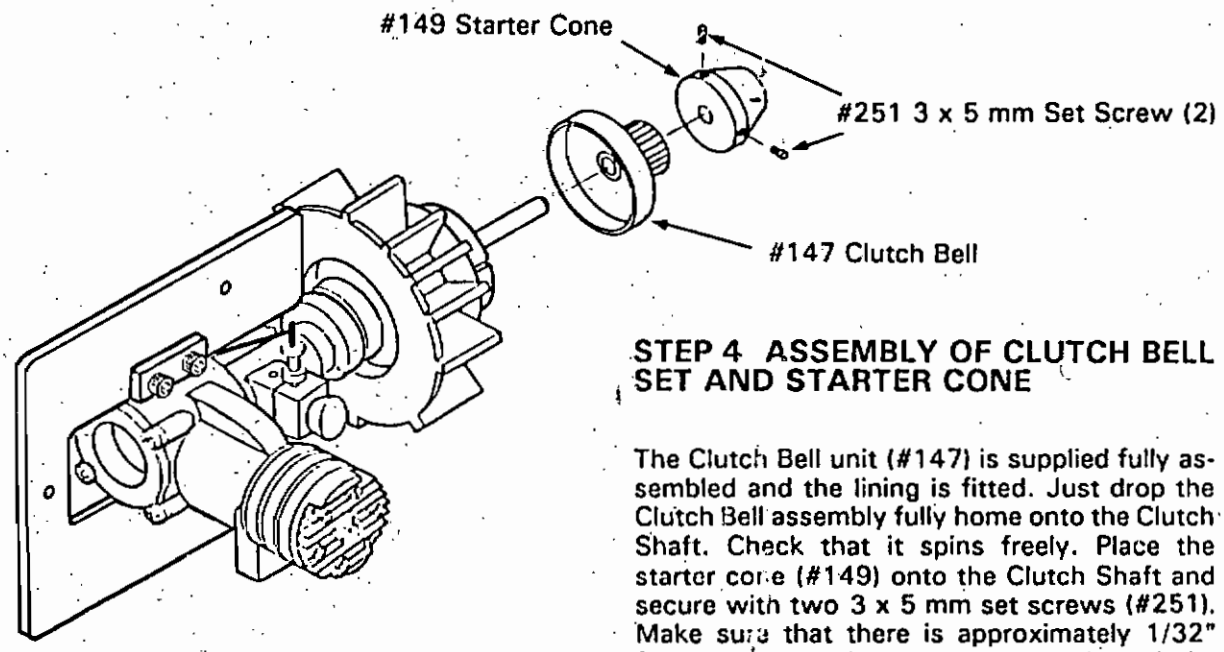
Fit the Clutch Assembly (#141) onto the flywheel (#155R) using two 3 x 10 mm socket head screws (#231). (L) Tighten firmly.

STAGE 1 ENGINE DRIVE UNIT ASSEMBLY (CONT'D) BAG #1 AND #2



STEP 3 ASSEMBLY OF MOTOR MOUNT

Assemble Engine Mount Plate (#136R) to the underside of your engine using four 3 x 16 mm socket head screws (#232) and four 3 mm lock nuts (#243). Use one 3mm washer (#276L) between the nut and Engine Mount Plate for each screw. Tighten firmly. The Engine Mount Plate (#136R) fits most popular 40 - 45 size engines. However, if your engine does not fit, consult your local dealer or call GMP directly.



STEP 4 ASSEMBLY OF CLUTCH BELL SET AND STARTER CONE

The Clutch Bell unit (#147) is supplied fully assembled and the lining is fitted. Just drop the Clutch Bell assembly fully home onto the Clutch Shaft. Check that it spins freely. Place the starter cone (#149) onto the Clutch Shaft and secure with two 3 x 5 mm set screws (#251). Make sure that there is approximately 1/32" free movement between the clutch and the starter cone. THIS IS VERY IMPORTANT TO ENSURE THAT THE ENGINE CAN IDLE FREELY. Tighten both set screws firmly. (L).

STAGE 2 COOLING FAN COVER ASSEMBLY

FIGURE 1

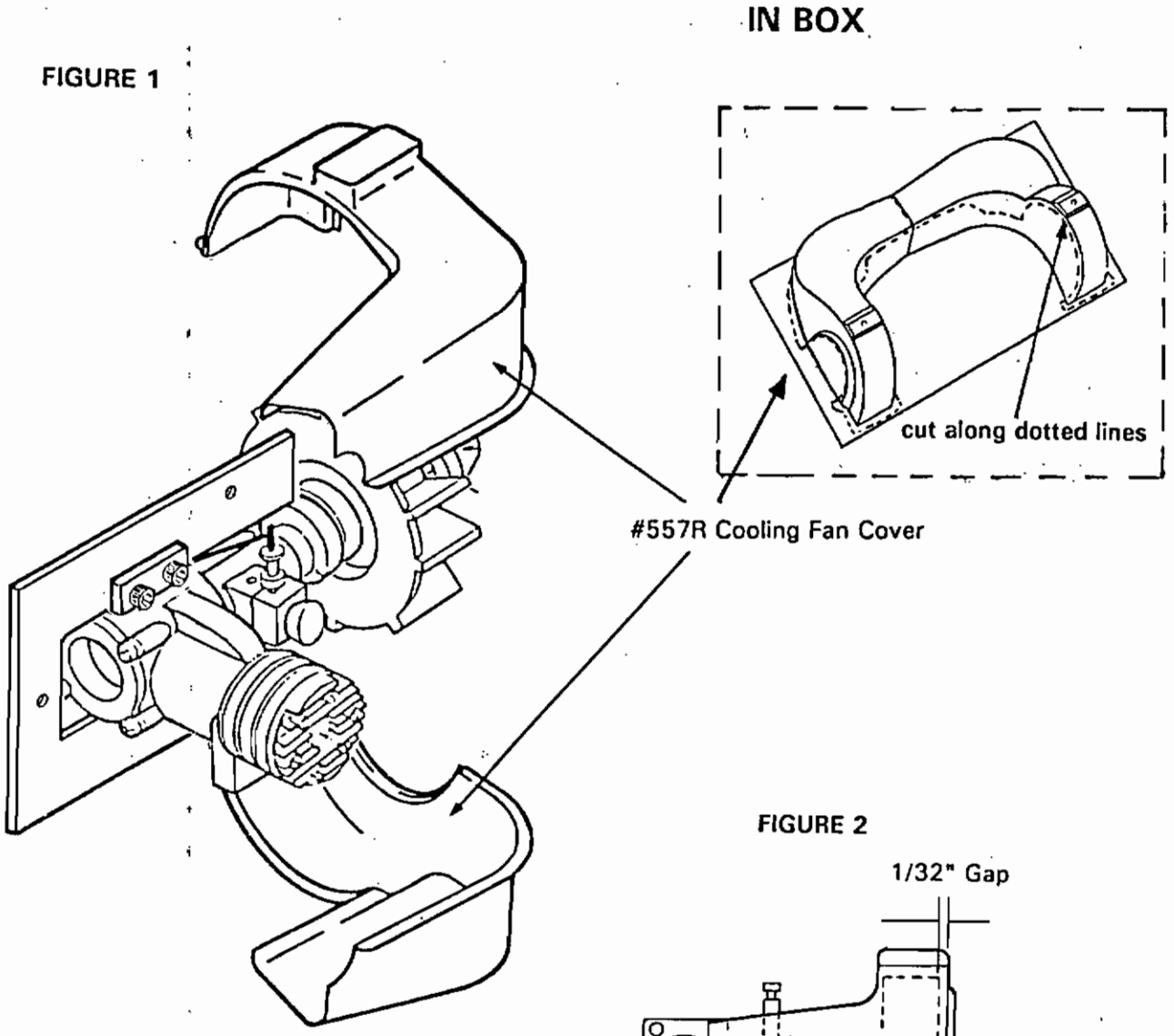
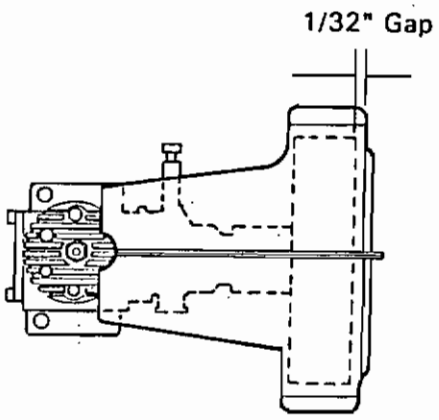


FIGURE 2



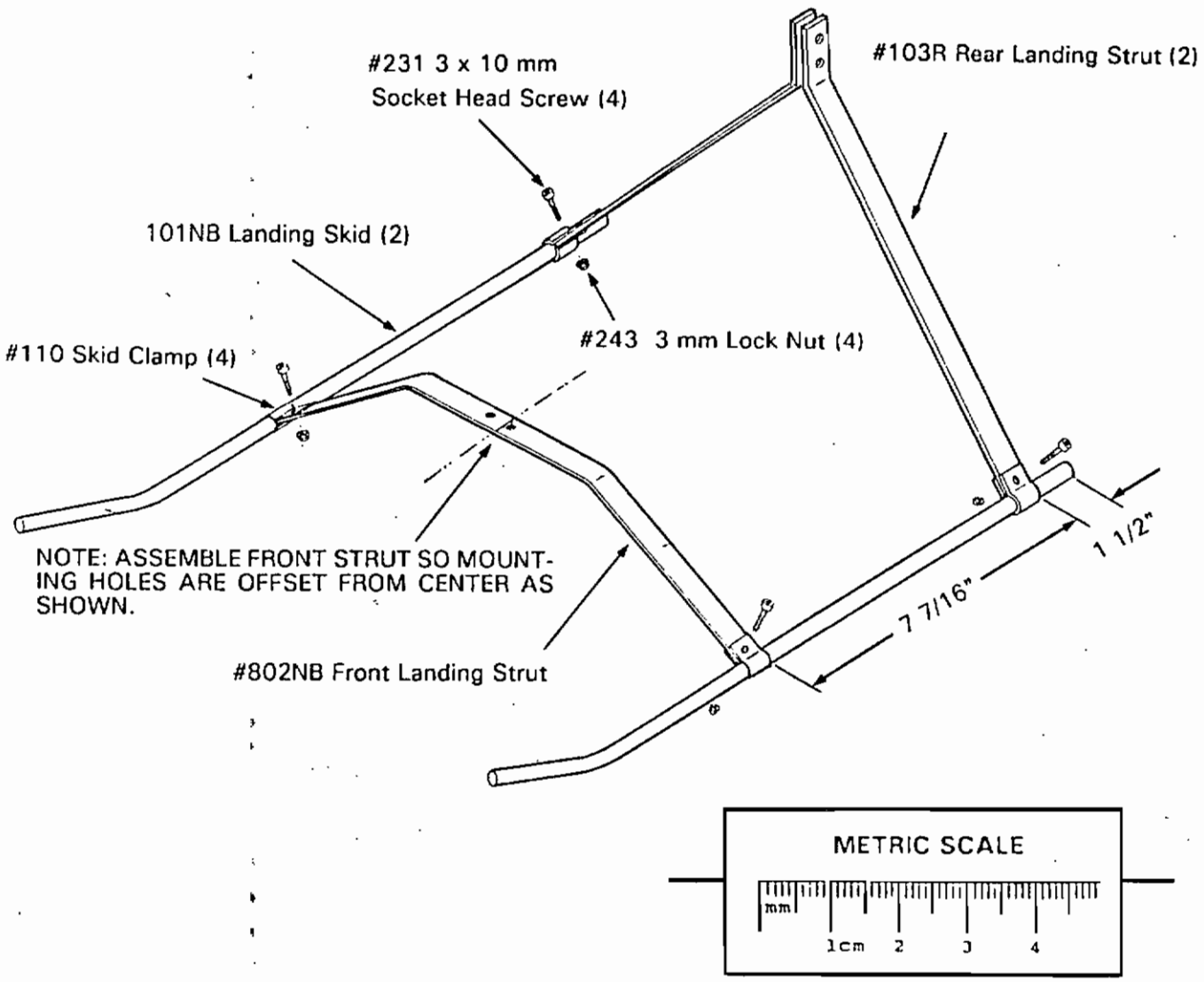
STEP 1 ASSEMBLY OF FAN COVER

First, cut out the two fan cover halves from the plastic sheet (#557R) using a pair of scissors, an Xacto knife or both, leaving 1/8" of flange all around the edges to be joined as shown in Figure 1. Do a trial fit onto your engine to be sure that no parts of the engine interfere with the correct position of the cover. If any engine parts foul the cover, trim the cover as necessary. When finally fitted, the gap between the outer surface of the cooling fan and the inner surface of the fan housing must be as close as possible, without touching, to ensure the best cooling efficiency - about 1/32" is correct (see Figure 2). Use Cyanocrylate glue to attach the two halves together. Put the engine/fan unit and cooling fan cover aside for use in the final assembly of the main chassis.

STAGE 3 LANDING GEAR UNIT ASSEMBLY

BAG #1 AND #3

FIGURE 1



STEP 1 ASSEMBLE SKID CLAMPS

Fit and position the landing skid clamps (#110) onto the skids as shown in Figure 1. After placing the clamps onto the skids, use a pair of pliers and close up the flanges until the gap is about 1/8", as shown in Figure 2.

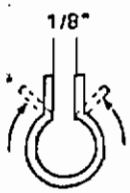


FIGURE 2

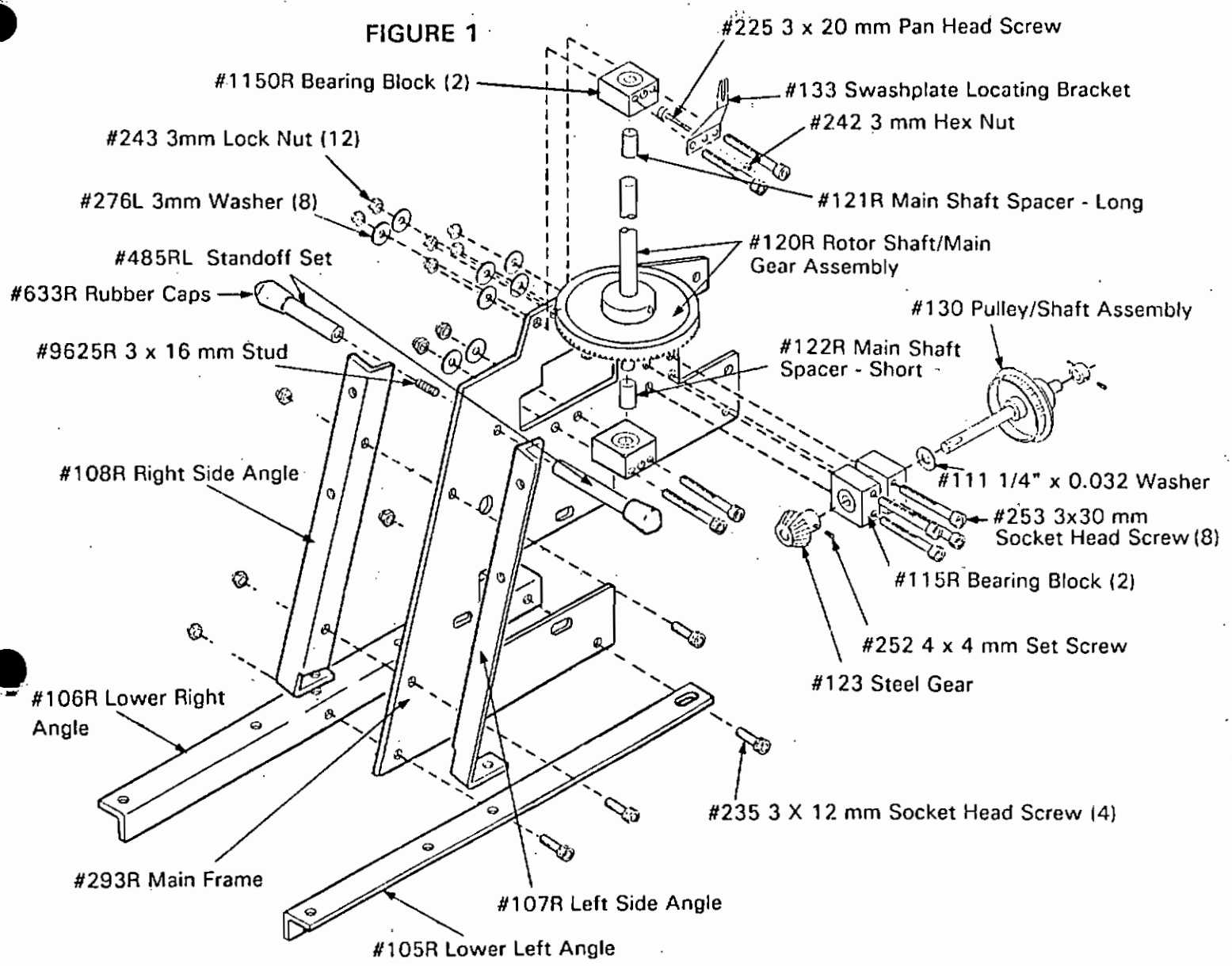
STEP 2 ASSEMBLE SKIDS TO STRUTS

Assemble front strut (#802NB) and two rear struts (#103R) to the skids (#101NB) using the screws and nuts as illustrated, but do not fully tighten to allow for minor adjustments when attaching the landing gear to the main chassis later in Stage 6: Step 1. Please note that the front strut must be assembled to the skids so that the two main mounting holes, which are about 3/4" apart, will be to the right side of center. Right side is the side your would consider on the right if you were the pilot sitting in the helicopter. For sailors/pilots we mean starboard. This is because the helicopter main frame is offset to the right in order to counteract for the main shaft and engine being on the left hand side of the frame.

STAGE 4 MAIN CHASSIS ASSEMBLY

BAG #1 AND #4

FIGURE 1



STEP 1 MAIN FRAME ASSEMBLY

Take the Main Frame (#293R) and attach the Lower Frame Angles (#105R and 106R) with two 3 x 12 mm socket head screws (#235) and two 3mm lock nuts (#243). Now assemble the two side angles (#107R and 108R) to the main frame in a similar manner. Note that there is a right side and a left side angle. Use two 3 x 12 mm socket head screws (#235) and two 3mm lock nuts (#243) in the upper two holes. Note that the hole on the bottom flange of the side angles will be used later to attach the landing gear.

STEP 2 CANOPY MOUNT ATTACHMENT

Refer to Figure 1 and assemble the canopy mount standoff set (#485RL) to the main frame using the 3 x 16 mm Stud (#9625R). Note that the longer standoff should be on the left side of the main frame and the shorter one on the right side. To ensure proper assembly, use a little blue Loctite on one quarter of the threads of the stud and screw this section one quarter of the way into the right mount. Let the Loctite set-up for a few minutes and then insert through the correct hole in the main frame so that the remaining threads are visible on the left side. Apply blue Loctite to these threads and screw on the left mount. Tighten both mounts firmly to the main frame. Now, fit one rubber cap (#633R) to each mount as shown in Figure 1.

STAGE 4 MAIN CHASSIS ASSEMBLY (CONT'D) BAG #1 AND #4

STEP 3 ROTOR DRIVE GEAR TRAIN

Take the swashplate locating bracket (#133) and fit a 3x20 mm pan head screw (#225) into the center hole with a 3mm hex nut (#242) facing outwards as shown in Fig. 1. Tighten the nut firmly to the locating bracket. A little blue Loctite on the screw threads before tightening will prevent the nut from "backing off" after many flights. This screw will form the pivot for the "T" lever assembly which will be fitted later. Now, take the Rotor Shaft/Main Gear Assembly (#120R) and assemble to the main frame in the followintg sequence:

Fit the long main shaft spacer (3/4" long #121R) ABOVE the gear (the opposite side to which the teeth face). The short main shaft spacer (7/16" long #122R) will be fitted later BELOW the gear. Next, slide onto the shaft one bearing block (#1150R). BEARING BLOCKS (#1150R) APPEAR VERY SIMILAR TO BEARING BLOCKS (#115R), HOWEVER, THE INNER DIAMETER OF THE BEARING IN #1150R IS 8MM WHEREAS THE INNER DIAMETER OF THE BEARING IN #115R IS 1/4". BE SURE TO USE THE CORRECT ONE! The extra hole on the side of the block should face away from the main frame. The exposed bearing surface should face down toward the spacer and gear. On the lower end of the shaft place the short spacer (#122R), followed by another bearing block with bearing (#1150R). This block should be placed on the shaft such that the exposed bearing is facing upwards toward the main gear. Place this assembly against the left side of the frame and secure the bottom bearing block with two 3 x 30 mm socket head screws (#253). Use a 3mm washer (#276L) on each screw before securing with two 3 mm lock nuts (#243). Extra care should be taken to ensure that the bearing block is horizontal with the cutout in the main frame for the main gear. This will ensure that the rotor shaft is perpendicular to the bearing and will ensure a smooth running drive train. Also, check that the screw heads are on the same side as the bearing block. Now fit the swashplate locating bracket, assembled earlier,onto the left side of the upper bearing block, using the two 3 x 30 mm socket head screws. Push the screws through the block and main frame to secure the top bearing block in the same manner as the bottom one. Fit two 3 mm washers and two 3mm lock nuts and tighten firmly, checking that the shaft can rotate freely with the smallest amount of up and down play. Again making sure that the block is perpendicular to the main rotor shaft.

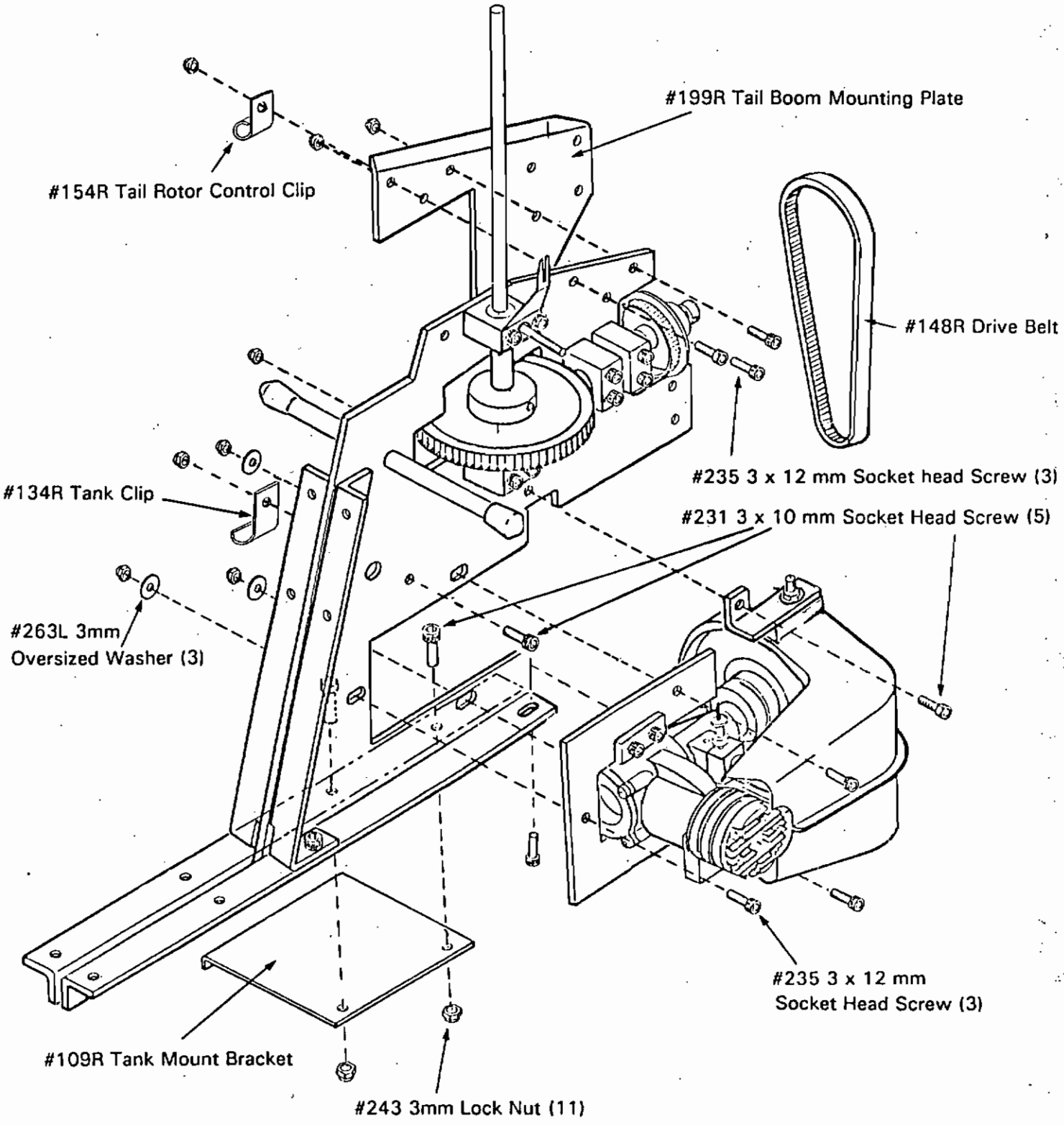
Now, take the Pulley/Shaft Assembly (#130) and add the 1/4" x 0.032 Washer (#111) on to the longest end of the shaft up against the nylon pulley. Refer to Figure 1. Then take the other two bearing blocks (#115R) and fit them onto the 3" shaft on the same long end. The blocks should be fitted so that on the first block the bearing faces the nylon pulley, and on the second block the bearing faces the flat end of the shaft. Now take the steel 15-tooth gear (#123) and slide it onto the shaft with the flat end. Fit this subassembly onto the left side of the main frame using four 3 x 30 mm socket head screws, four 3 mm washers and four 3 mm lock nuts in a similar fashion to the main shaft bearing blocks. Apply blue Loctite to a 4 x 4 mm set screw (#252) and secure the steel gear (#123) onto the shaft. Be sure to key the set screw into the flat part of the shaft and minimize end play before tightening the set screw well! See A.

A. It is very important to assemble the chassis and gear train corrrectly so please, if you are ever in doubt of any of the steps, refer to Figure 1.

STAGE 5 ENGINE/MAIN CHASSIS FINAL ASSEMBLY

BAG #1 AND #5

FIGURE 1



METRIC SCALE

STAGE 5 ENGINE/MAIN CHASSIS FINAL ASSEMBLY (CONT'D)

BAG #1 AND #5

FIGURE 2

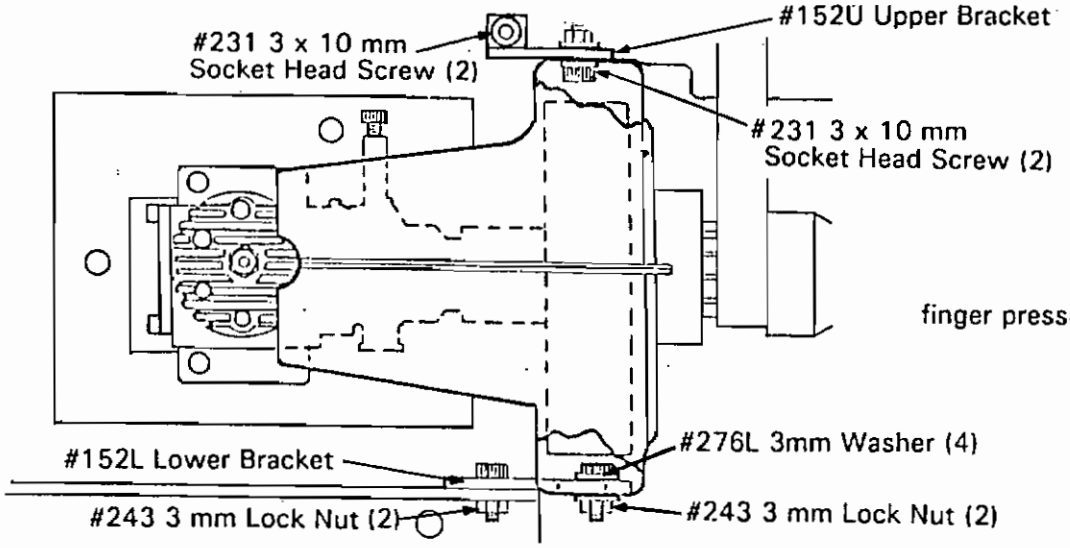
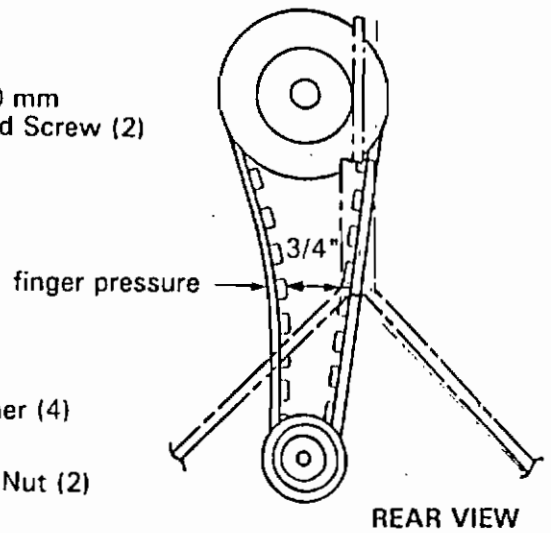


FIGURE 3



REAR VIEW

STEP 1 MOUNT FAN BRACKETS TO FAN COVER

Use an X-Acto knife or drill motor fitted with a 3/16" drill bit to puncture the pre-indented positions on the top 'block' and bottom sections of the fan cover. Mount the two fan cover brackets (#152U and #152L) to the fan cover at these locations with two 3 x 10 mm socket head screws (#231), four 3 mm washers (#276L), and two 3 mm lock nuts (#243) as shown in Figure 2. Bracket (#152U) mounts on top of the upper 'block' of the fan cover as shown. Bracket (#152L) mounts on the inside of the bottom of the fan cover with the slotted end towards the fan. The 3 x 10 mm socket head screw should secure the bracket so that the slot is as far foward towards the main frame as possible.

STEP 2 MOUNT ENGINE ASSEMBLY TO MAIN FRAME

Make sure the fan cover is in position over the fan of the engine assembly previously constructed. Fit the engine plate onto the left side of the main frame with one 3 x 12 mm socket head screw (#235), one 3 mm oversized washers (#263L) and one 3 mm lock nut (#243) in the top mounting hole as shown in Figure 1. Tighten snugly, yet still allowing the engine plate to move. Now rotate the engine crankshaft up to allow the drive belt (#148R) to fit onto the pulleys. Once the belt is in place, secure the engine plate to the main frame with two more 3 x 12 mm socket head screws, two 3 mm oversized washers and two 3 mm lock nuts. Before tightening, the engine assembly 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" (see Figure 3). The toothed belt can be quite slack since it does not rely upon tension and the resulting friction for its grip as a normal Vee belt does. The efficiency of the Rebel drive system depends upon a relatively slack belt tension so as to minimize friction and, hence, transmision drive losses at this point. Be careful though not to set the belt too slack since it could then ride-up over the plastic gear teeth and wear them rapidly. The adjustment shown in Figure 3 will provide the correct tension.

STEP 3 MOUNTING FAN COVER

Mount the two fan cover brackets (#152U and #152L) to the main frame with two 3 x 10 mm socket head screws and two 3mm lock nuts. Bracket #152U mounts above and in front of the fan on the left rear side of the main frame, and bracket #152L mounts on the left rear lower angle. Again, Figure 2 illustrates the proper mounting positions. Be sure to adjust the mounts so the fan cover does not interfer with the rotation of the fan and is in the correct location for maximum cooling efficiency as explained in Stage 2 - Cooling Fan Cover Assembly. This is very important if you do not want an overheated engine.

STEP 4 ASSEMBLING TANK MOUNT AND FASTENER

Attach the tank mount bracket (#109R) to the bottom of the right lower angle with two 3 x 10 mm socket head screws and two 3 mm lock nuts. Be sure that the flange on the tank mount faces down. Now fit the tank clip(#134R) to the right side of the main frame using a 3 x 10 mm socket head screw and a 3 mm lock nut. The tank will be fitted later using a rubber band.

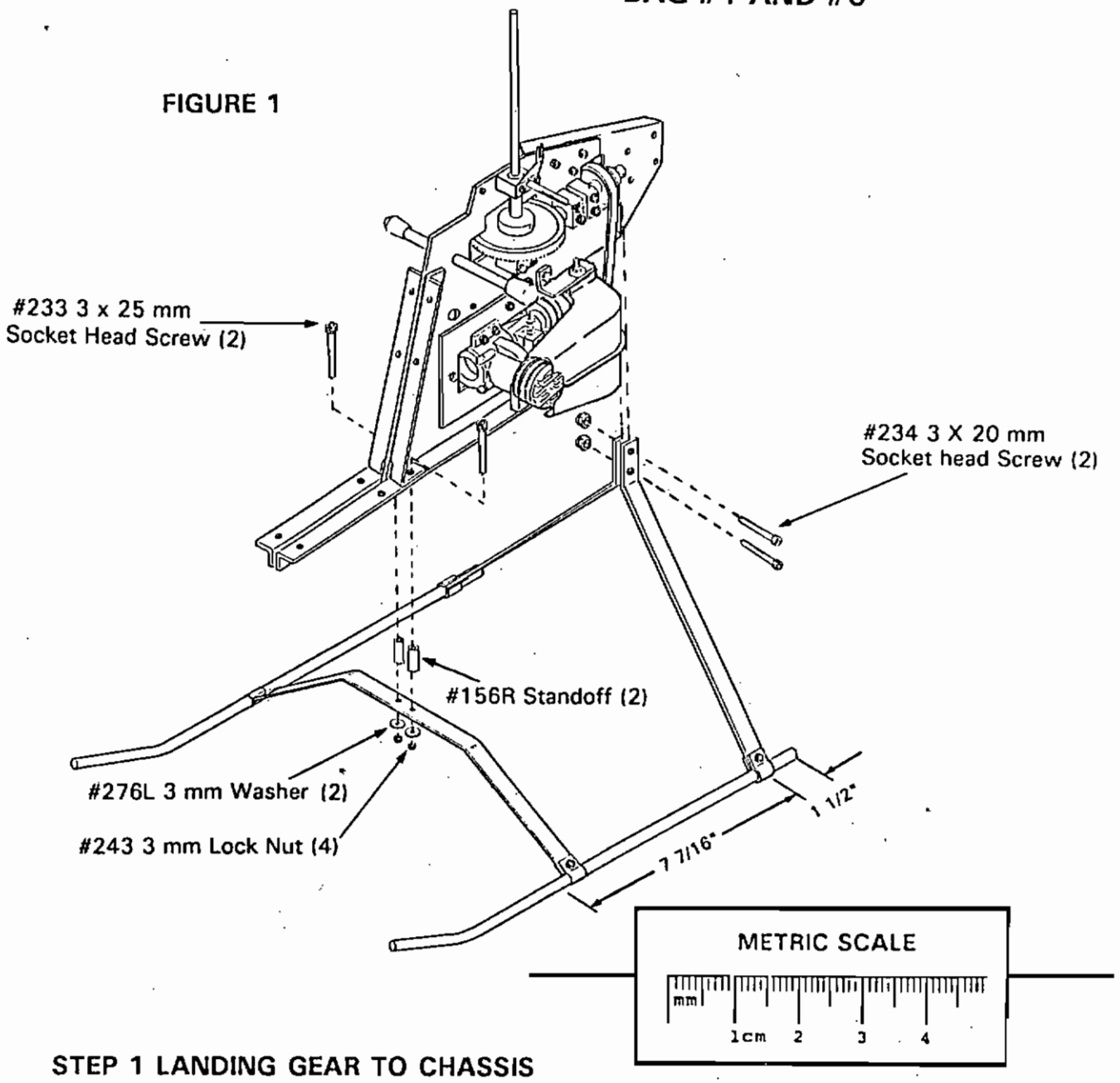
STEP 5 TAIL BOOM PLATE ATTACHMENT

Fit the tail boom mounting plate (#199R) to the right side of the main frame using three 3 x 12 mm socket head screws and three 3mm lock nuts in the three upper holes only. The other two attachment points will be used when the landing gear is installed. Before you attach the lock nut onto the middle 3x12mm socket head screw of the three upper screws, place the tail rotor control clip (#154R) on the screw as shown in Finure 1.

STAGE 6 LANDING GEAR/MAIN CHASSIS

BAG #1 AND #6

FIGURE 1



STEP 1 LANDING GEAR TO CHASSIS ASSEMBLY

Place the main chassis assembly onto the landing gear assembly. Fasten the front strut to the chassis using two 3 x 25 mm socket head screws (#233), two 3mm washers (#276L) and two 3 mm lock nuts (#243) as shown in Figure 1. Use the standoff spacers (#156R) to allow for adequate clearance. Attach the rear struts to the outside of the main frame and tail boom plate, using two 3 x 20 mm socket head screws (#234), and two 3mm locknuts (#243). Tighten all nuts securely. Readjust the rear skid clamps as needed and then fully tighten them. To avoid loosening of the clamps after many flights, some builders further secure all the skid clamps to the skids with a sheet metal screw. Drill 1/16" holes and use #2 x 1/4" sheet metal screws. The use of a little red Loctite will help to permanently secure the screws. (see Figure 2)

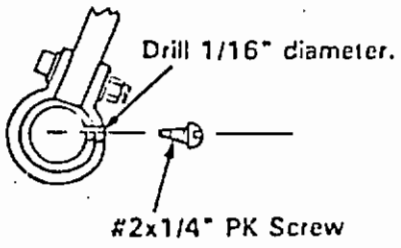
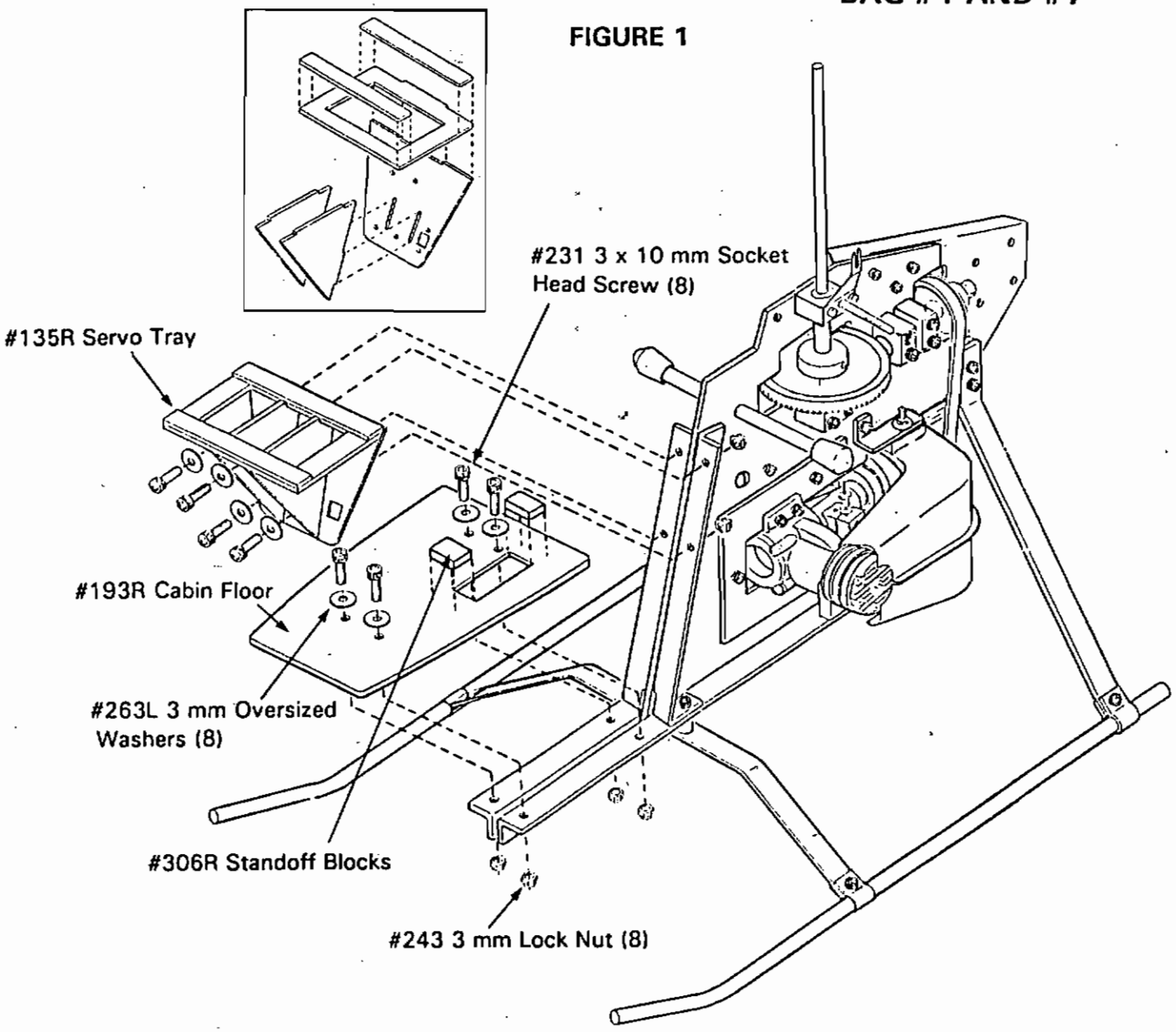


FIGURE 2

STAGE 7 SERVO TRAY AND CABIN FLOOR ASSEMBLY

BAG #1 AND #7

FIGURE 1



STEP 1 ASSEMBLE SERVO TRAY

Remove the die-cut servo tray parts (#135R) from the plywood sheet. Assemble using cyanoacrylate glue or epoxy as shown in Figure 1. Make sure that all glue joints are sound as a failure of the servo tray would result in loss of control of the helicopter!

STEP 2 ASSEMBLE THE CABIN FLOOR

Attach the two standoff wood blocks (#306R) to the cabin floor (#193R) as shown in figure 1. Use 'cyano' or epoxy glue. These standoffs elevate the throttle servo so it does not interfere with the proper mounting of the Rebel canopy.

STEP 3 FINISH AND PAINT

Finish and paint the assembled servo tray and cabin floor using your favorite finish. Colored "Dope" or polyurethane works fine obtainable at your local hobby store.

STEP 4 FIT SERVO TRAY

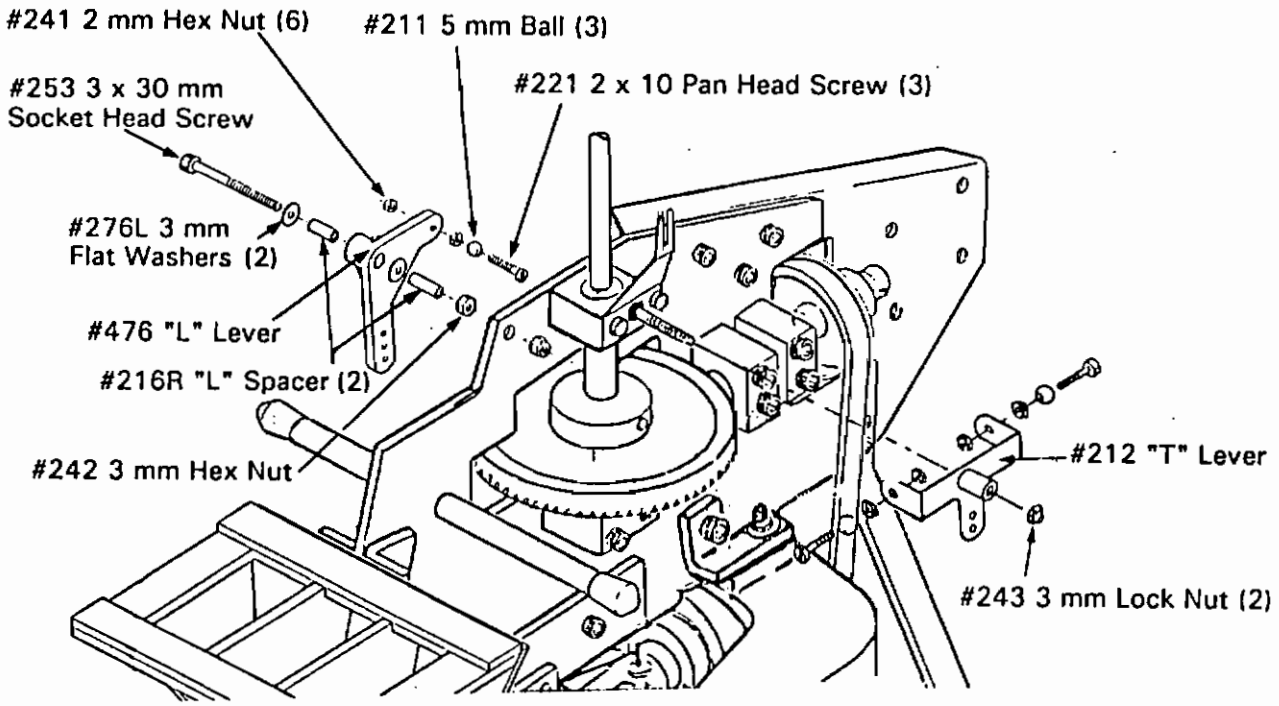
Mount the servo tray to the main chassis using four 3 x 10 mm socket head screws (#231), four 3 mm oversized washers (#263L), and four 3mm lock nuts (#243). Make sure the washers go between the screw head and wood tray as shown is Figure 1.

STEP 5 FIT CABIN FLOOR

Secure the cabin floor to the lower angles protruding from the front of the main frame using four 3 x 10 mm socket head screws (#231), four 3 mm oversize washers (#263L), and four 3 mm lock nuts (#243) in the same fashion as the servo tray attachment.

STAGE 8 CONTROL SYSTEM MECHANICAL ASSEMBLY BAG #1 AND #8

FIGURE 1



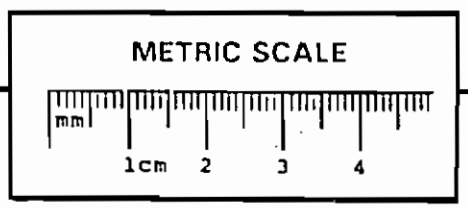
STEP 1 ROLL CONTROL ASSEMBLY

Take the plastic "L" lever (#476) and fit a 5 mm ball (#211) to the hole of the shorter arm by means of a 2 x 10 mm pan head screw (#221) and two 2 mm hex nuts (#241), as shown in Figure 1. Be sure to attach the ball assembly to the correct side of the lever! Now take a 3 x 30 mm socket head screw (#253) and add in the following order:

One 3 mm flat washer (#276L), followed by a "L" spacer (#216R), and the "L" lever, then another 3 mm flat washer, followed by another "L" spacer (#216R). Next attach a 3mm hex nut (#242) and tighten to the point that while you hold the 'L' lever at the ends with your thumb and index finger, it has no sideways 'play' yet can still rotate freely. Now fit the whole assembly onto the right hand top side of the main plate and secure with a 3 mm lock nut (#243).

STEP 2 PITCH "T" LEVER ASSEMBLY

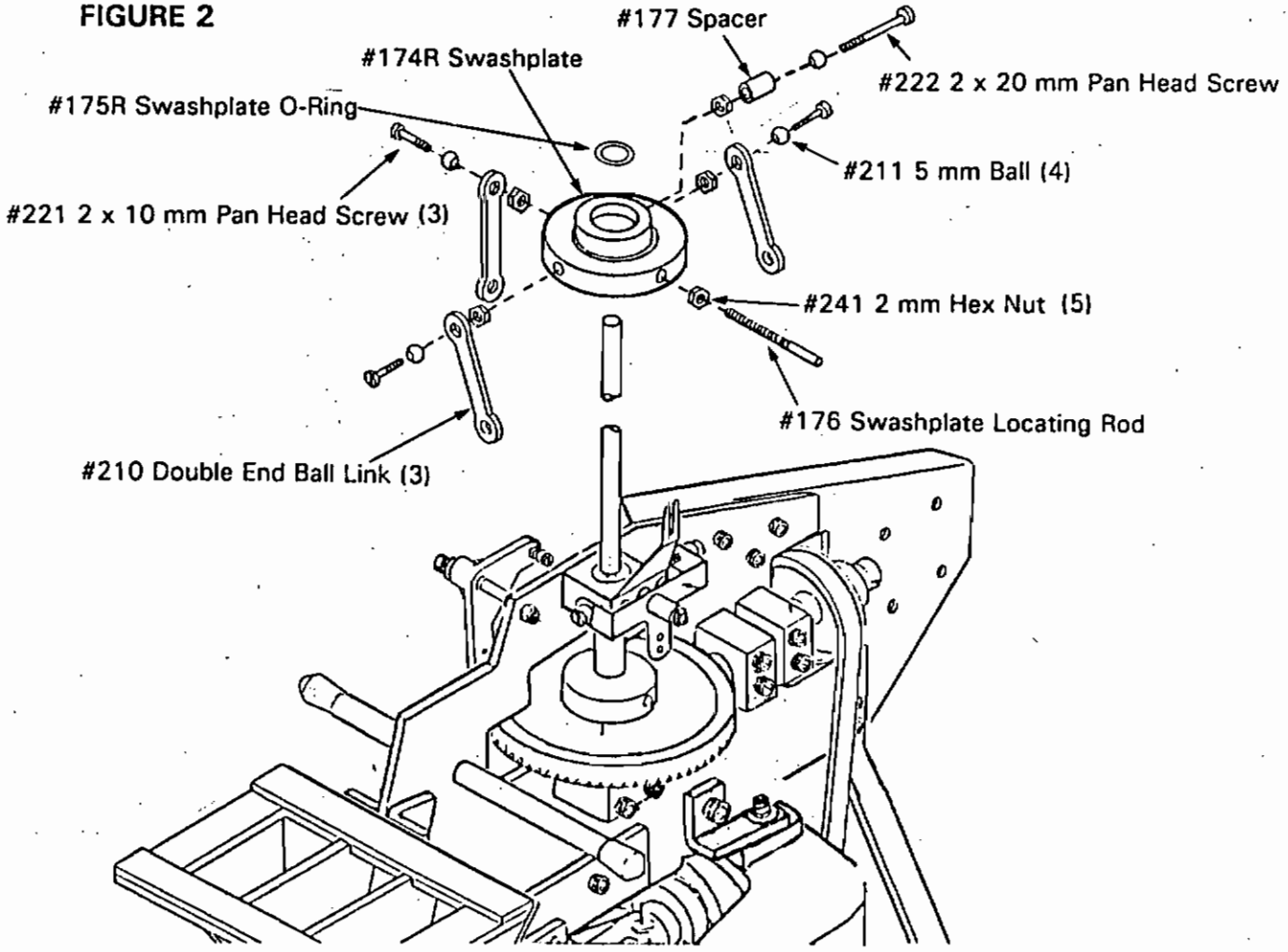
Take the "T" lever (#212) and fit two 5 mm balls (#211). These balls are placed on a 2 x 10 mm pan head screw (#221) and locked in place with a 2 mm hex nut (#241). Use blue Loctite. The screw is then fitted into the small holes on the sides of the lever with the balls facing outward. A 2 mm hex nut (#241) is then fitted to the screw projecting through to the inside of the "T" lever and locked up tightly. Use blue Loctite. Make sure that these two balls are very firmly fitted to the "T" lever since a failure here can result in a control failure of the helicopter. Now slide the completed lever onto the 3 mm screw which has previously been fitted to the center hole of the swashplate locating bracket. Fit a 3 mm lock nut (#243) onto the screw to retain the "T" lever and tighten so that the lever can move but 'free play' is minimal.



STAGE 8 CONTROL SYSTEM MECHANICAL ASSEMBLY (CONT'D)

BAG #1 AND #8

FIGURE 2



STEP 3 SWASHPLATE ASSEMBLY

Take the swashplate (#174R) and fit three 5 mm dia. balls (#211) onto the lower ring. The lower ring is the one with the largest diameter. Using three 2 x 10 mm pan head screws (#221), place a ball onto each screw, followed by a 2 mm hex nut (#241) to trap the ball between the head of the screw and the nut. Use Loctite.

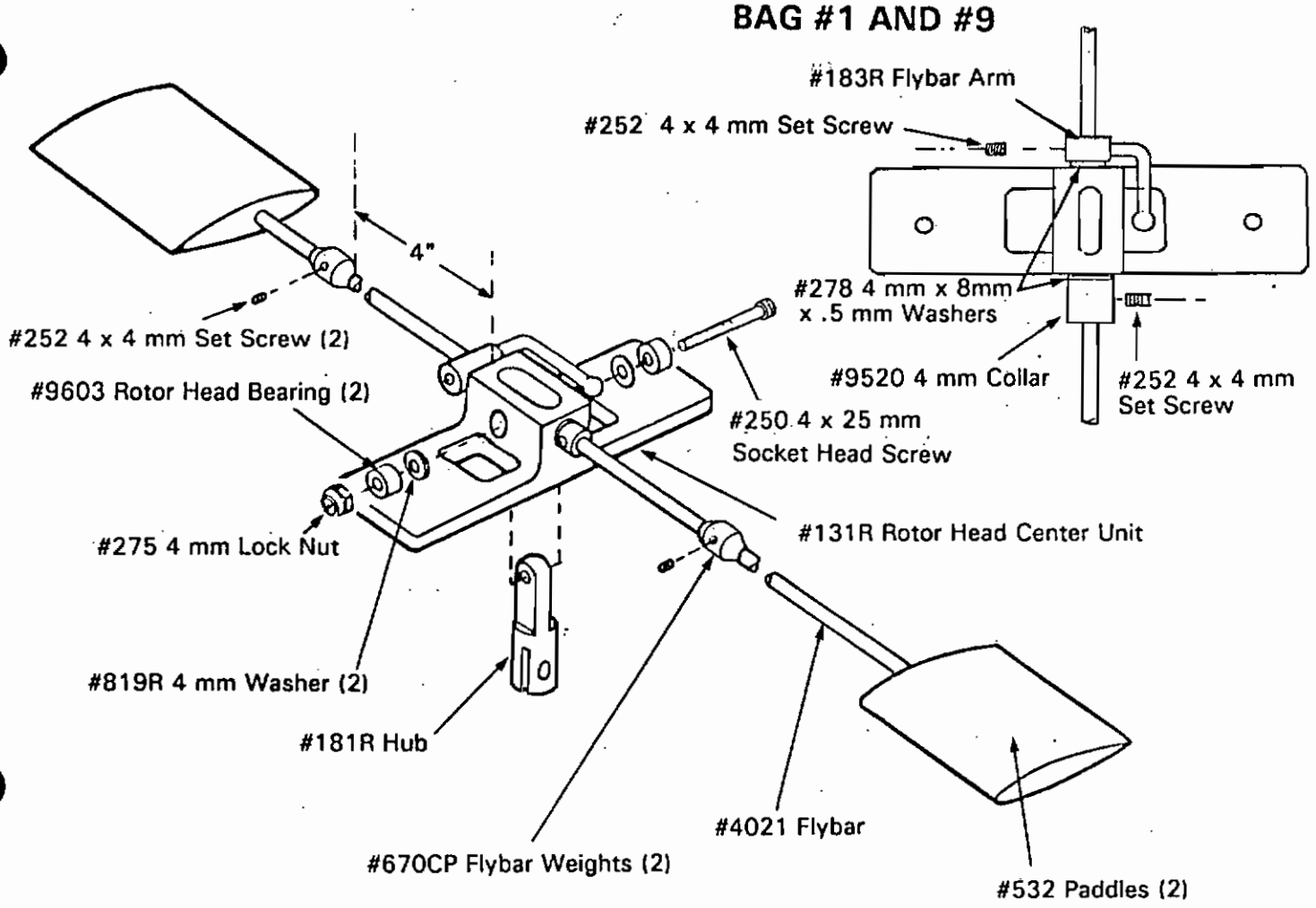
Fit the swashplate locating rod (#176) with a threaded portion on one end into the remaining 2 mm hole. Use a 2 mm hex nut (#241) to lock the wire into the swashplate. Use Loctite. The upper ring of the swashplate (smaller diameter) has two 2 mm tapped holes. Only one is used. Fit a 2 x 20 mm pan head screw (#222) through a 5mm ball, followed by the brass spacer (#177). Secure the spacer to the screw with a 2 mm hex nut (#241) and tighten firmly. Use Blue Loctite. Now fit the whole assembly into either one of the 2 mm tapped holes of the swashplate upper ring. Use loctite and tighten firmly.

Now insert the Swashplate O-Ring #175R carefully inside the center hole of the swashplate so that it fits in to the groove made especially for it.

Slide the swashplate down over the main rotor shaft making sure that the O-Ring does not come out of the groove. A small amount of Vaseline or similar grease can be used to ease this step. Move the swashplate down until the locating pin is in the center of the swashplate locating bracket assembled earlier. Now connect the swashplate to the three balls on the "T" lever and "L" lever using the three double ended ball links (#210) as shown in Figure 2.

STAGE 9 ROTOR HEAD ASSEMBLY

BAG #1 AND #9



STEP 1 ASSEMBLE ROTOR HEAD

Take the rotor head center unit (#131R) and place the hub (#181R) into the center slot of the rotor head unit so that the hole in the hub lines up with the larger holes in the rotor head unit (facing lengthwise.) Now, push one of the special flat 4 mm washers (#819R) followed by a bearing (#9603) into each of the holes so that the two washers are tight between the bearing and hub. Now secure the rotor head to the hub with a 4 x 25 mm socket head bolt (#250) and 4 mm lock nut (#275). Push the screw through the bearing, washer, hub, washer and out through the other bearing. Screw on the 4 mm lock nut and tighten such that the hub can freely swing within the head, yet 'free play' is minimal.

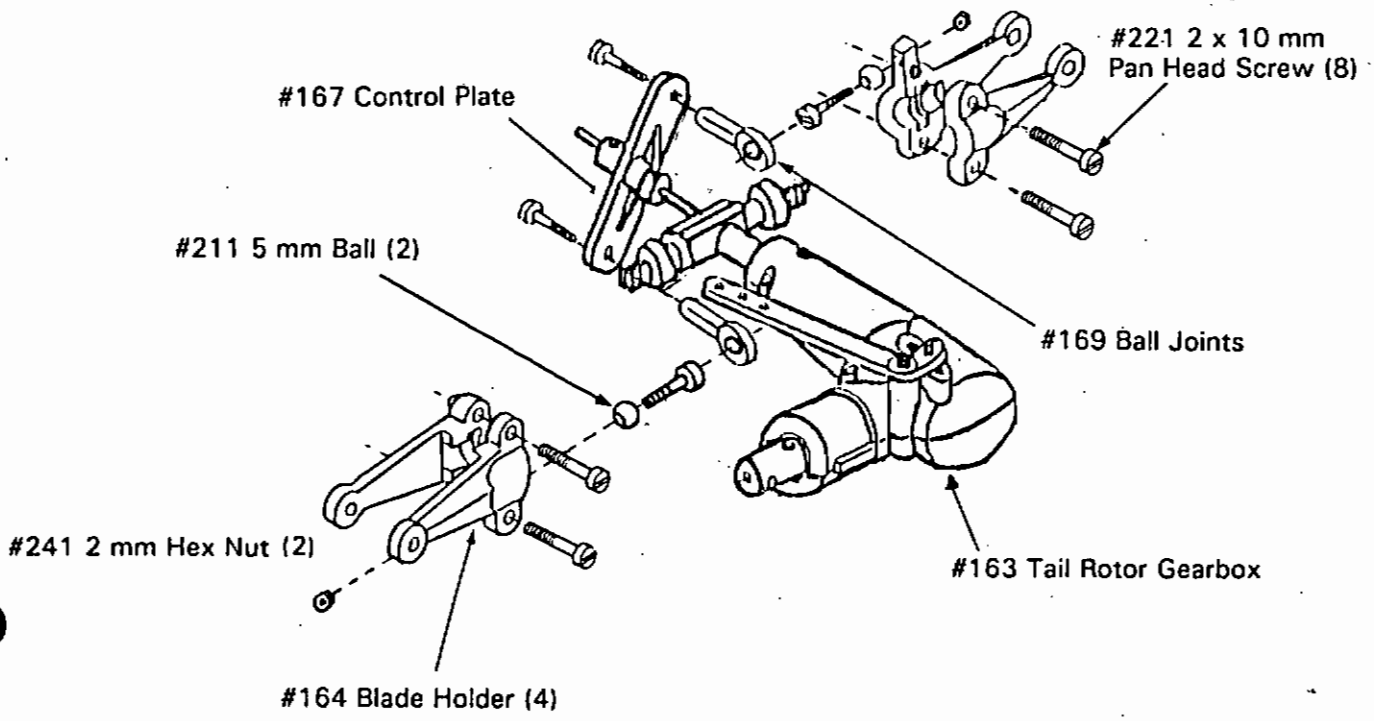
Now mark the center of the flybar (#4021) with a scratch mark or a pencil and slide it through the holes in the upper portion of the center rotor. Add a 4mm x 8mm x .5mm washer (#278) to each side. Fit the flybar arm (#183R) to one side making sure that the ball is towards the middle of the rotor head. Then add the 4 mm collar (#9520) to the other side. Center the flybar, use finger pressure to keep the flybar control arm and collar tight against the hub and tighten the flybar control arm using a 4 x 4 mm set screw (#252) and secure the collar with a 4 x 4 mm set screw (#252). Be sure that the flybar remains centered and that it is free to rotate yet has no lengthwise play. Install one flybar weight (#670CP) to each side of the flybar and tighten the 4 x 4 mm set screws (#252) with each weight positioned 4" from the rotor head. This distance is not critical but it should be the same on each side. Mix a little slow cure epoxy and put some on the threads of the flybar. Then thread the plastic paddles (#532) onto the flybar. The ends of the flybar should just protrude through the hole in the paddle by about one thread. Make sure that the paddles are in the same plane as each other, are 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). Set the rotor head aside for balancing and attachment in a later stage.

NOTE: IT IS VERY IMPORTANT TO ASSEMBLE THE 4 X 25 MM SOCKET HEAD SCREW (#250) SO THAT THE SCREW HEAD IS ON THE SAME SIDE AS THE FLYBAR ARM BALL.

STAGE 10 TAIL BOOM AND TAIL ROTOR GEARBOX ASSEMBLY

BAG #1 AND #10

FIGURE 1



STEP 1 ASSEMBLE TAIL ROTOR GEARBOX

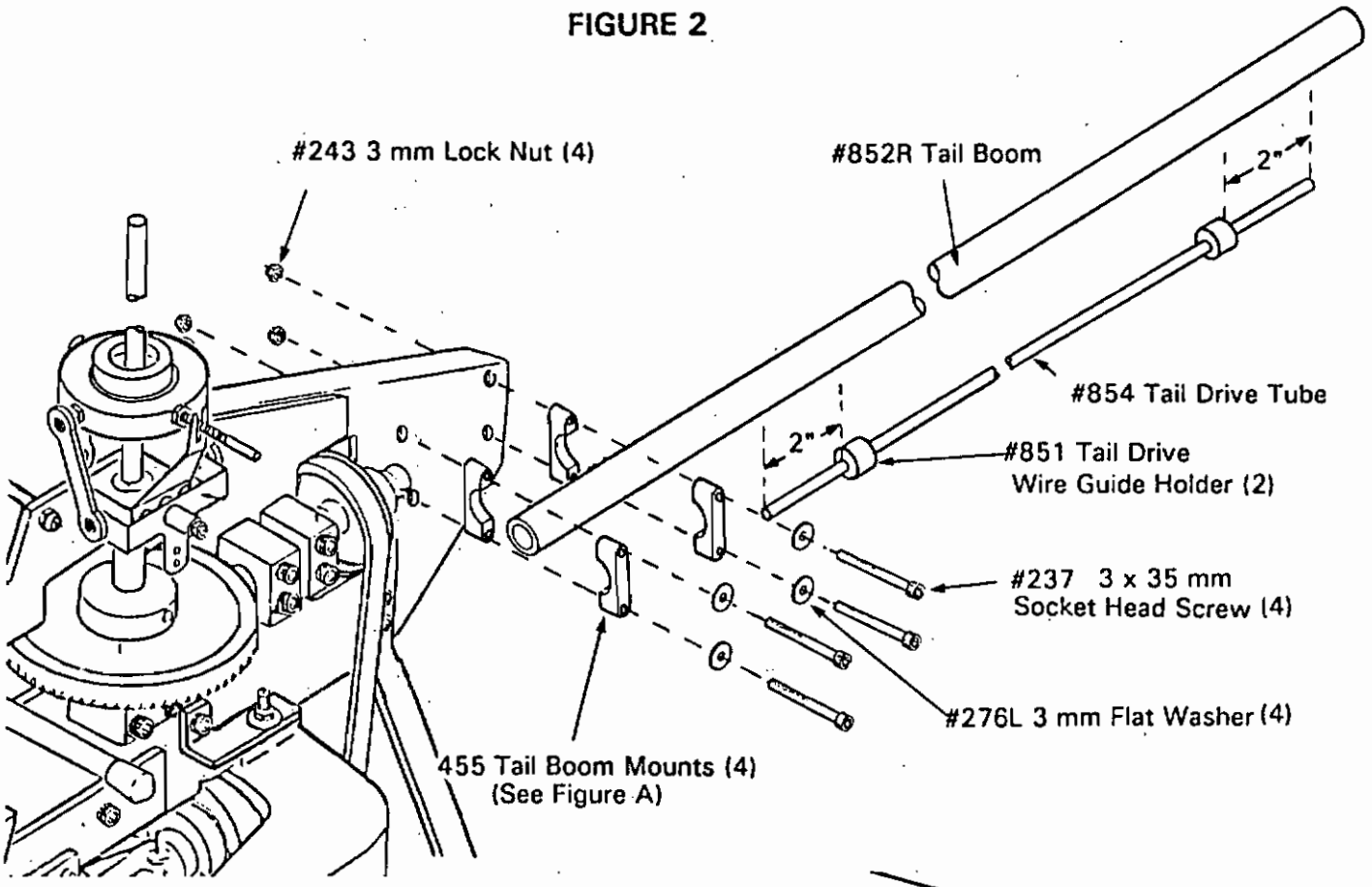
The gearbox (#163) has been assembled for you with the exception of the blade holders and control linkages which change the pitch of the tail blades. There are four black plastic blade holders (#164) - two have a projection for a control ball, the other two do not. Fit one pair of blade holders (one with a projection and one without) one each side of the tail rotor hub. The cavities in the plastic blade holders will fit over the steel thrust washers. Now secure the four blade holders by four 2 x 10 mm pan head screws (#221) as shown in Figure 1.

Use a little cyanocylate glue on the threads to secure the units as Loctite will greatly reduce the strength of the plastic. The 5 mm ball (#211) is fitted onto the inside of the control arm of each blade holder by means of a 2 x 10 mm pan head screw (#221) trapping the ball between the screw head and plastic control arm. A 2 mm hex nut (#241) secures it on the other side of the blade arm. Take two ball joints (#169) and fit them over the balls with the threaded end of the ball joint facing the control plate (#167). Using a 2 x 10 mm pan head screw (#221) fix the ball joints (#169) to the control plate. The screws should be tightened sufficiently so that there is no play, but should not be overtightened so as to damage the plastic material of the control plate. You may have to loosen and adjust the collars holding the pitch plate in place to accomplish this step, but do not worry about this because the final location of the collars will be set later.

STAGE 10 TAIL BOOM AND TAIL ROTOR GEARBOX ASSEMBLY (CONT'D)

BAG #1 AND #10

FIGURE 2



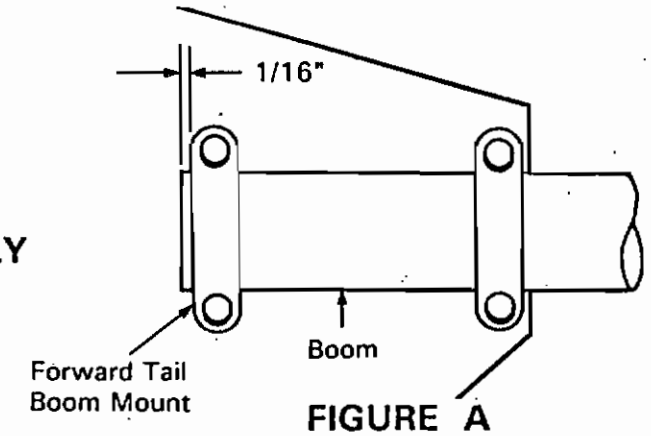
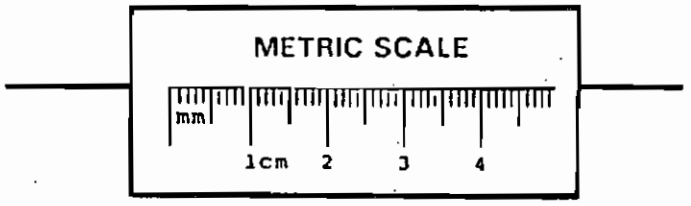


FIGURE A

STEP 2 TAIL ROTOR TUBE ASSEMBLY

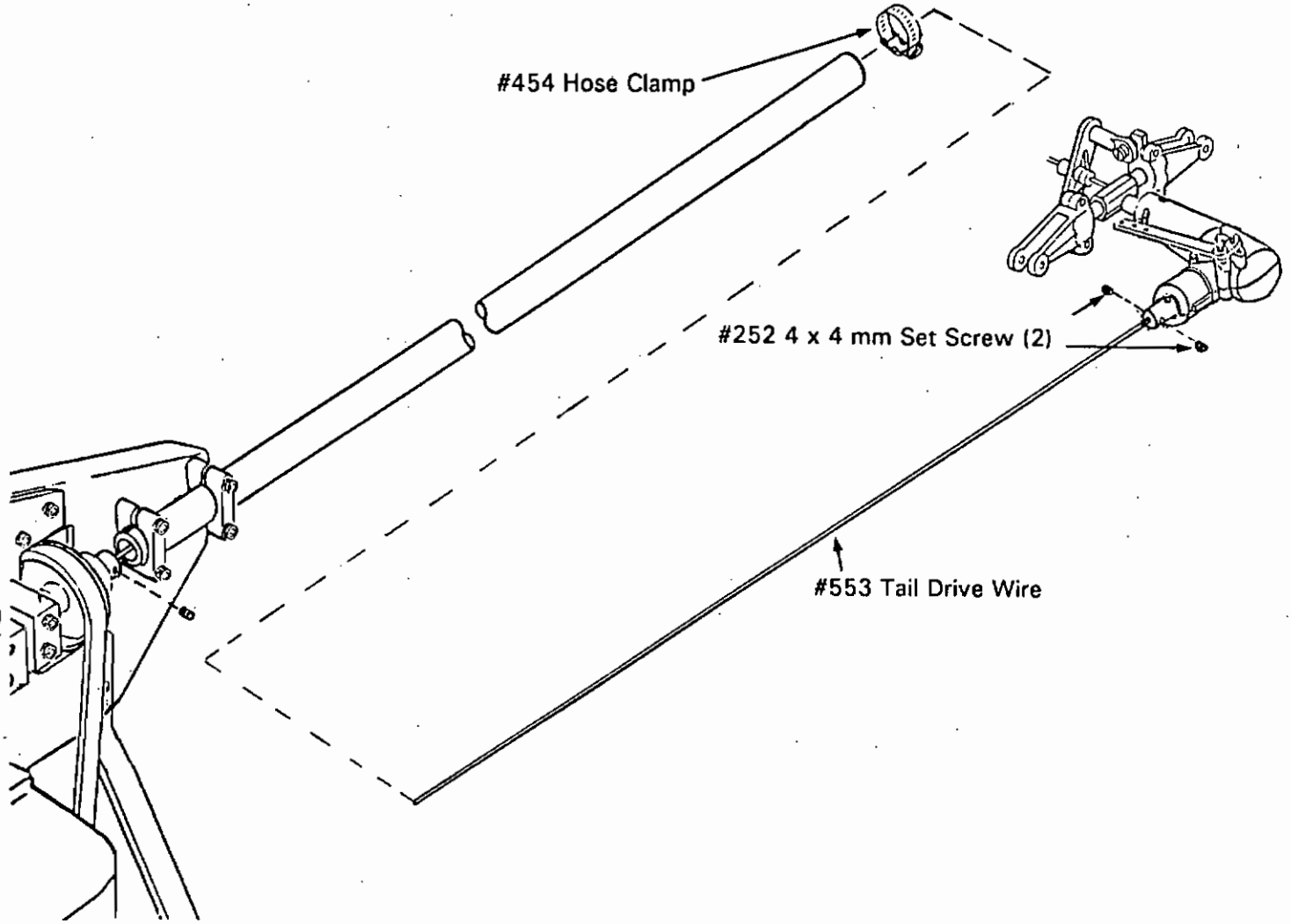
Take the brass tube (#854) for the tail drive wire and install the two foam guides (#851) onto the tube, 2" from each end, using cyanoclate glue, as shown in Figure 2. Now install the assembly into the tail boom (#852R) so that the wire is centered lengthwise the boom. Run a little cyanocylate glue down the insides of the boom so as to secure the foam tail tube holders. Now fit the tail boom to the left side of the main frame using the four plastic tail boom mounts (#455), four 3 x 35 mm socket head screws, four 3 mm washers (#276L) and four 3 mm lock nuts (#243), as shown in Figure 2. Be sure that the tail boom is 'in line' with the tail drive shaft and is parallel to the lower edge of the main plate. Also, the tail boom should protrude forward of the front tail boom mount by 1/16" (See Figure A)



STAGE 10 TAIL BOOM AND TAIL ROTOR GEARBOX ASSEMBLY (CONT'D)

BAG #1 AND #10

FIGURE 3



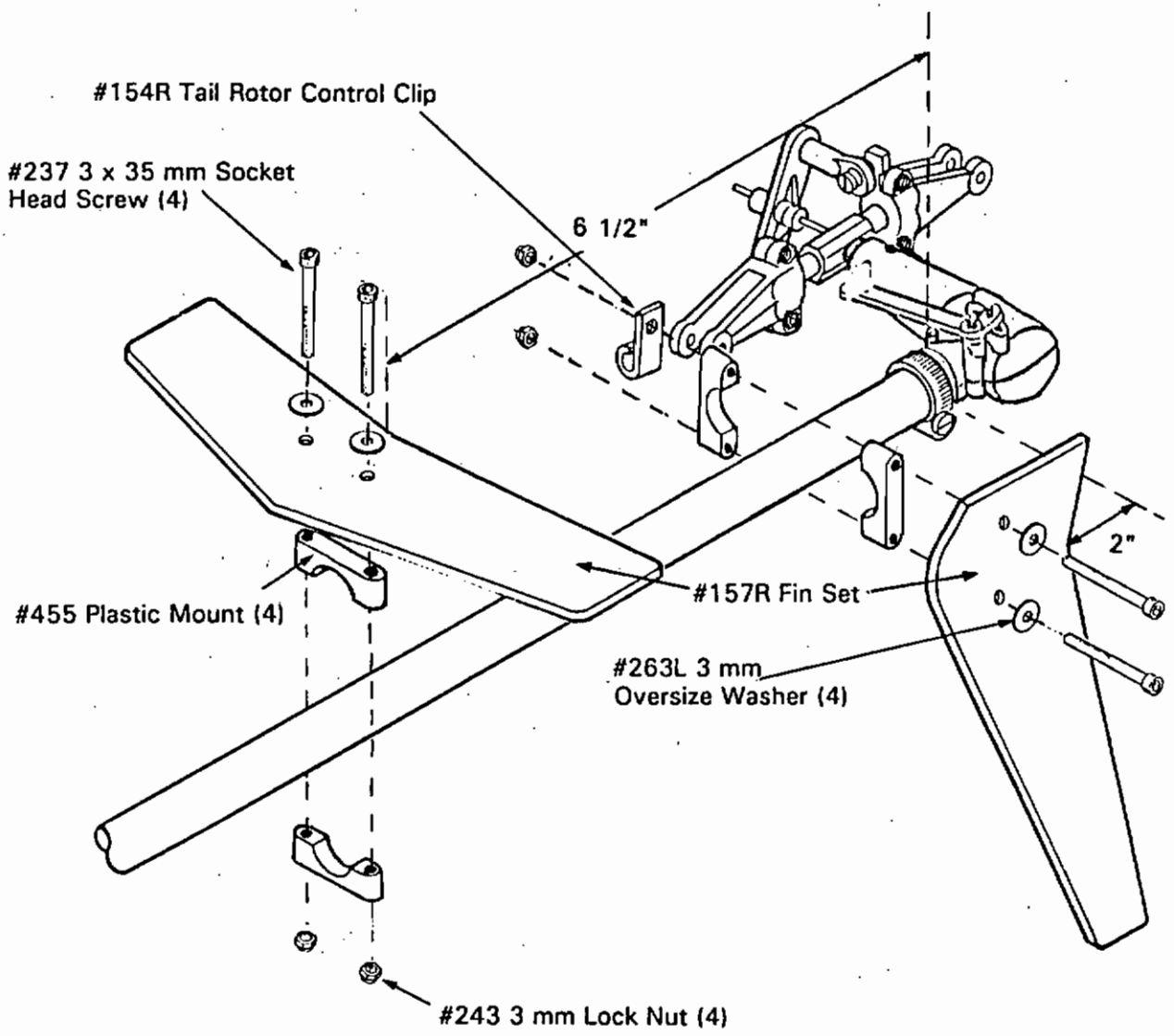
STEP 3 TAIL ROTOR DRIVE ASSEMBLY

Take the tail drive wire (#553) and fit one end 1/2" into the center hole of the tail rotor gearbox input drive shaft. Secure the wire with two 4 x 4 mm socket head set screws (#252) in such a way that the wire runs true. The screws should be adjusted carefully to achieve this. Use blue Loctite. Now fit the retaining clamp (#454) loosely over the rear end of the tail boom and then insert the tail drive wire into the rear end of the boom. You may have to use a little patience in locating the drive tube. After passing through the tube, the tail drive wire should be fed into the small hole in the rear of the tail shaft drive and pulley. Be sure the set screw pre-attached to the 1/4" dia. collar is removed.

The tail drive wire (#553) has been factory cut to the proper length. However, to maintain the proper fit of about 1/16" lengthwise clearance, the tail boom may have to be adjusted. Once this is done, remove the wire and lubricate with light grease or medium weight oil. Now, re-install the wire and rotate the gearbox so that it points to the right side of the model, and that the shaft is at 90 degrees from the verticle. Push the tail rotor gearbox fully home into the tail boom and tighten the tail clamp (#454) to retain the gearbox in this position. Now, secure the drive wire to the tail shaft drive and pulley with the 4 x 4 mm set screw in the 1/4" dia. collar. Use blue loctite.

STAGE 11 TAIL SURFACE ASSEMBLY

BAG #1 AND #7



STEP 1 PREPARE TAIL SURFACES

Use "Hot Stuff" cynocrylate glue on all edges then round off the corners and edges of the vertical fin and horizontal stabilizer. Sand lightly all over. Paint with your favorite finish (filling grain first, if you wish) and put aside to dry. Decorate with the decals provided after drying.

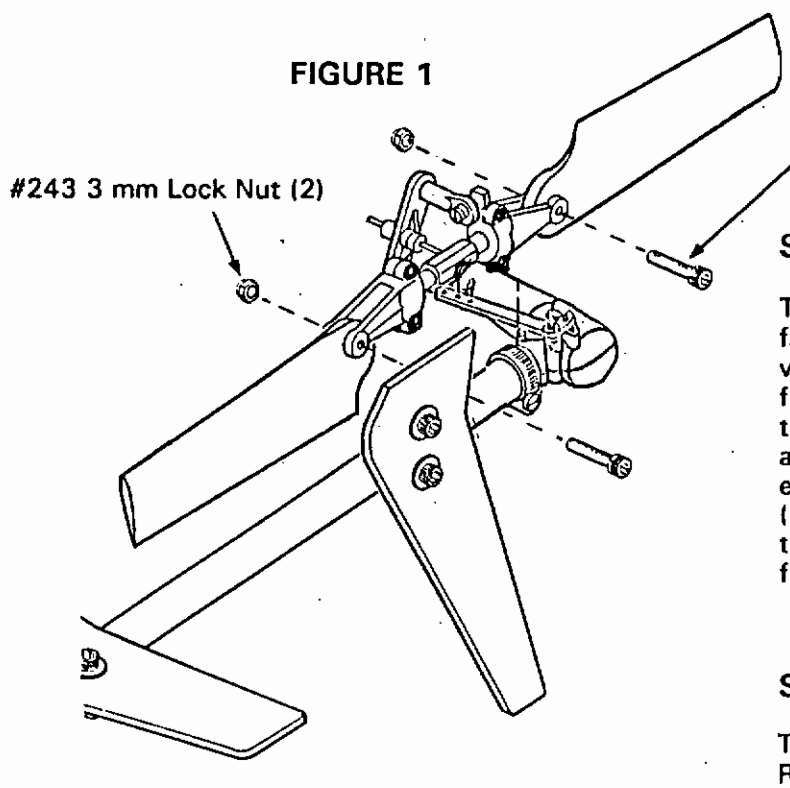
STEP 2 FIT STABILIZERS

Fit the horizontal and vertical fin set (#157R) as shown using the four plastic mounts (#455), four 3 x 35 mm socket head screws (#237), four oversized 3 mm washers (#263L), and four 3 mm lock nuts (#243). Before securing the verticle fin with 3mm lock nuts, attach the tail rotor control clip (#154R) to the upper screw as shown. Take care not to tighten the 3 mm lock nuts too much in order to avoid crushing the magnalite sheet. Also make sure the oversized washers go between the screw head and stabilizers.

STAGE 12 MAIN AND TAIL ROTOR BLADE ASSEMBLY

BAG #1 AND IN BOX

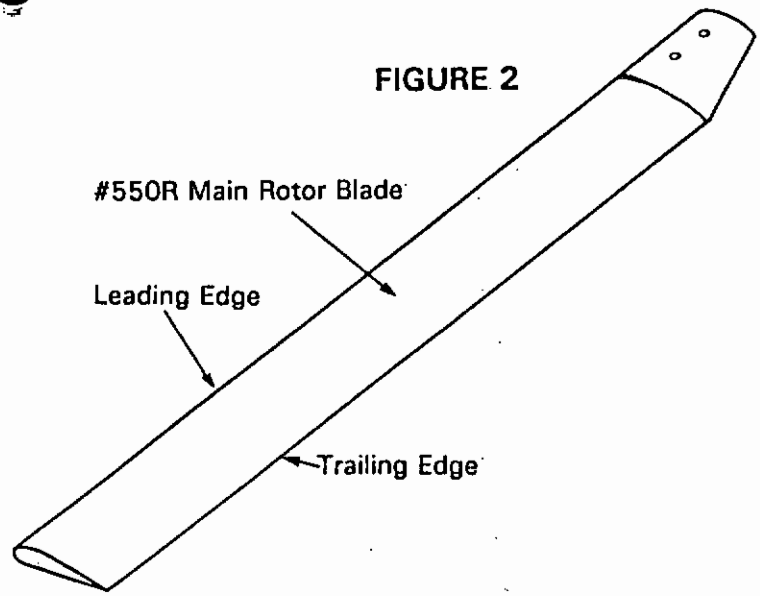
FIGURE 1



STEP 1 TAIL ROTOR BLADES

The two tail rotor blades (#9551) are already finished and can be installed at your convenience, but don't forget to install before flying! Fit the blades to the blade holders, with the leading edge facing the direction of rotation as shown in Figure 1. Use two 3 x 16 mm socket head screws (#232) and two 3 mm lock nuts (#243). Tighten so that the blades are free but that there is enough friction so they will not fall freely by their own weight.

FIGURE 2

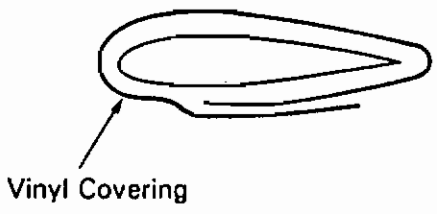


STEP 2 MAIN ROTOR BLADES

The main rotor blades (#550R) included in your Rebel kit are specifically designed, selected and match for use with the GMP Rebel line of RC helicopters. The characteristics of this blade enable the Rebel to lose or gain altitude much quicker with a small decrease or increase in rotor speed than other fixed pitch helicopters which tend to 'float' and the weight of the blades is also important to the proper performance of 'Rebel'. With these specially designed rotor blades, your Rebel has an altitude control response approaching that of the more sophisticated collective pitch RC helicopters!

Your rotor blades should be covered with the vinyl film provided in the kit. Before applying the vinyl it is advisable to lightly spray colored "Dope" onto the first two or three inches of the blade on the inside section (the end with the holes) and on the blade tip. This will prevent any oil or grease from soaking into the wood. If you wish to further strengthen your blades, you may cover the first 3" with a very light 3/4 ounce glass cloth. Use cynoacrylate to adhere the cloth to the blades. This step is highly recommended - your blades will last much longer. Now to cover the blades, strip the paper backing from the vinyl covering and cover each blade with the pattern shown in Figure 3. If handled gently and carefully, covering a blade with vinyl is very easy. It can be made more 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 pulling it too tightly. Also, be sure to sharply crease the covering as you go around the trailing and leading edge to avoid the covering from 'lifting off' later.

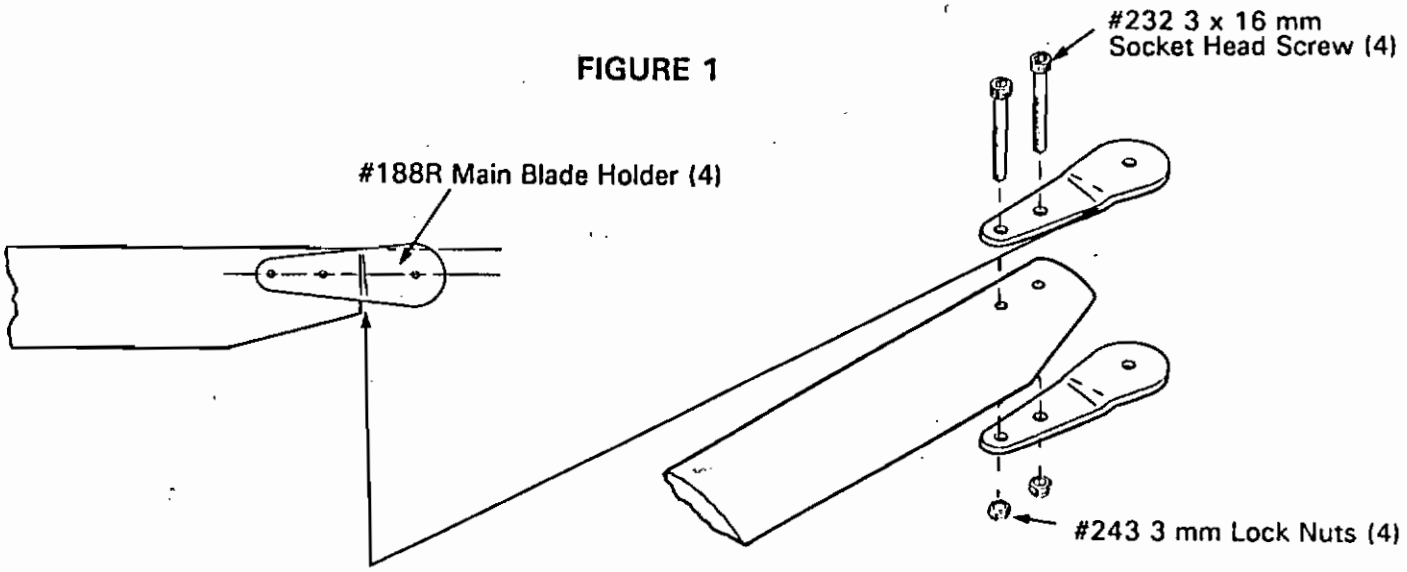
FIGURE 3



STAGE 13 MAIN ROTOR HEAD FINAL ASSEMBLY AND BALANCING

BAG #1 AND #9

FIGURE 1

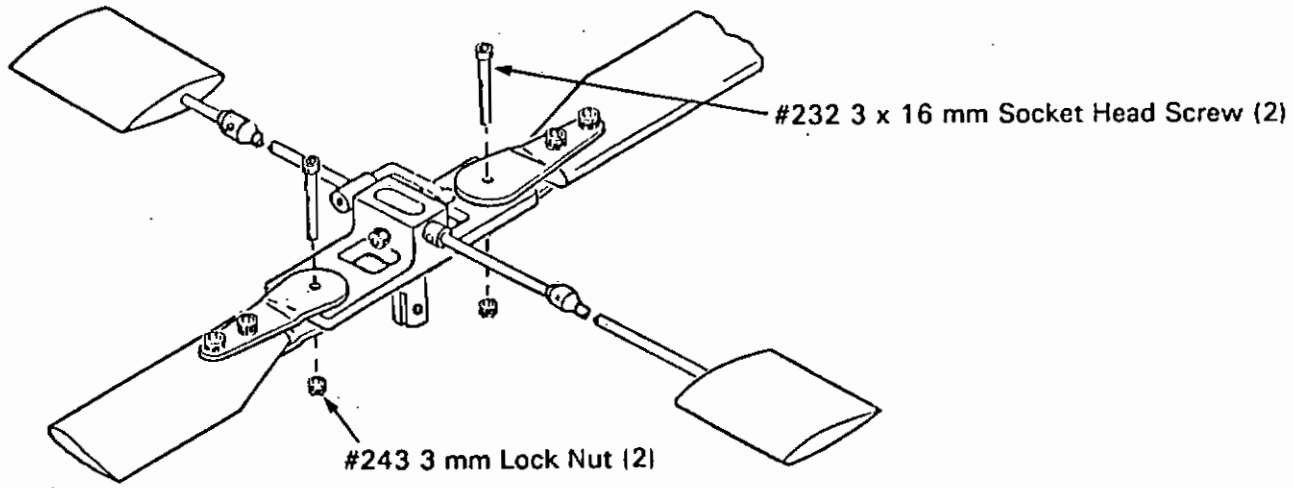


NOTE: BEND IN BLADE HOLDERS FACE THE TRAILING EDGE OF THE MAIN ROTOR BLADE

STEP 1 ASSEMBLE BLADE HOLDERS TO MAIN BLADES

Take the four main blade holders (#188R) and attach two to each blade, as shown in Figure 1, using four 3 x 16 mm socket head screws (#232) and four 3 mm lock nuts (#243). PLEASE NOTE THE BLADE HOLDERS ARE PRE-BENT FOR THE PROPER PITCH SETTING, ABOUT 3 1/2 DEGREES, AND BLADE THICKNESS. THEY MUST BE ATTACHED TO THE BLADES EXACTLY AS ILLUSTRATED TO PUT THE LEADING EDGE OF THE MAIN BLADE HIGHER THAN THE TRAILING EDGE. Be careful not to over-torque the bolts as this will damage the wood! Also, carefully check the alignment of the holders to the blades as shown

FIGURE 2

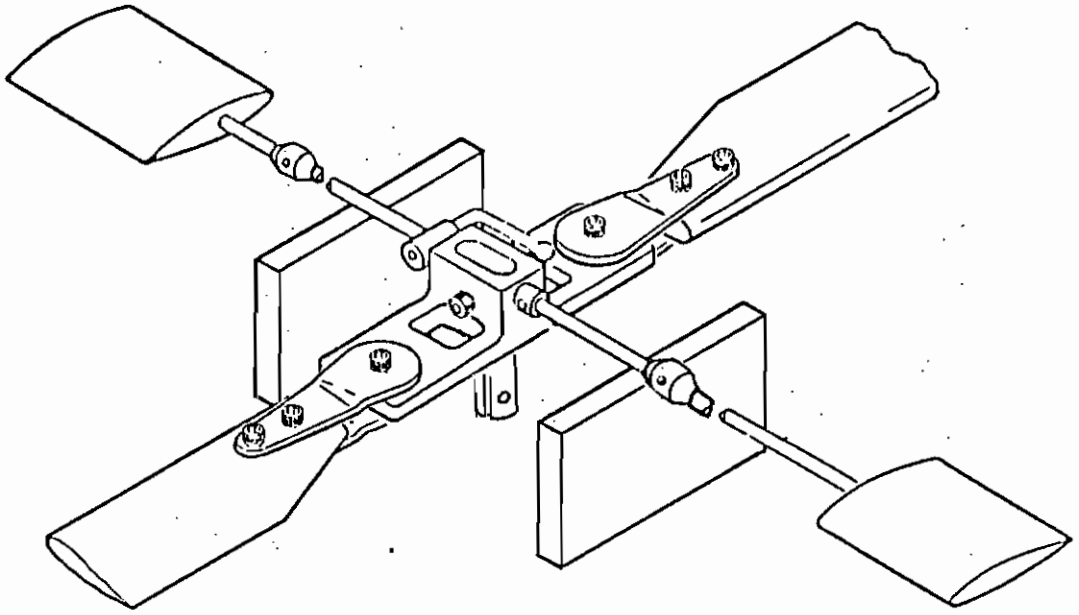


STEP 2 FIT BLADES TO HEAD

Fit the blades onto each end of the rotor head main unit by the end holes in the blade holders as shown in Figure 2. Use two 3 x 16 mm socket head screws (#232) and two 3 mm lock nuts (#243). Tighten so the blades can still swing with pressure, yet will not swing freely by their own weight.

STAGE 13 (CONT'D)

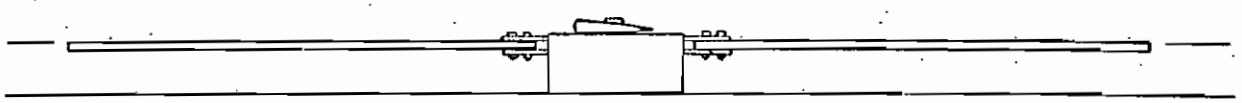
FIGURE 3



STEP 3 BALANCE MAIN ROTOR SYSTEM

Rest the flybar onto two parallel sharp edges so that the whole blade system can teeter on the flybar, as shown in Figure 3. One blade will probably fall and this is the heavy blade. Cut a colored strip of "Monocote" or any thin plastic sheet will do, about 3/4" wide and 2 1/2" long. Fold this around the light blade near the tip and secure down firmly. This will provide some extra weight for the light blade and also provide you with recognition of which blade is 'high' or 'low' during 'tracking' of the main blades. Add additional tape until the head 'balances' with both blade tips equal distance above the flat balancing surface, as shown in Figure 4. Balancing the head is very important and, if done carefully, will help to avoid vibration and shaking of the helicopter during the initial flight stages.

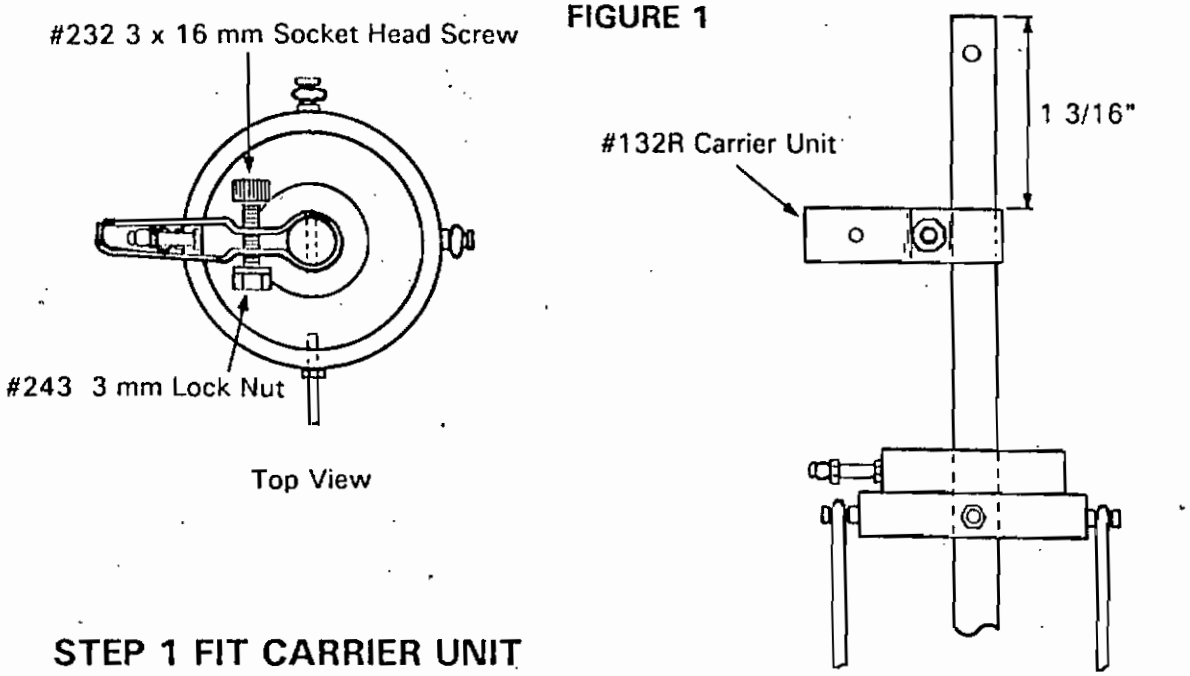
FIGURE 4



STAGE 14 ASSEMBLE AND FIT CARRIER UNIT

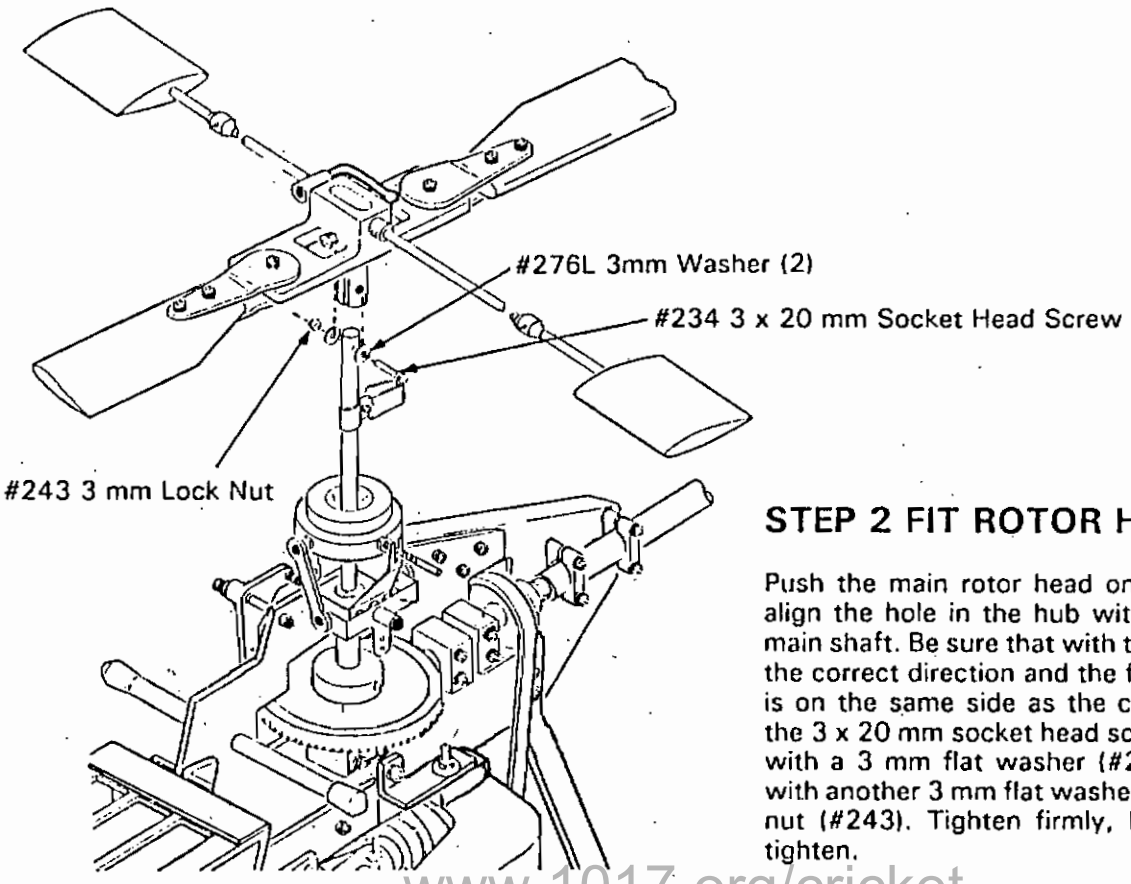
BAG #1 AND #9

FIGURE 1



STEP 1 FIT CARRIER UNIT

Fit the carrier unit (#132R) onto the main rotor shaft and secure in positon with a 3 x 16 mm socket head screw (#232) and a 3 mm lock nut (#243) as shown in Figure 1. Please take care in aligning the carrier unit as improper alignment will drastically effect the flight performance!



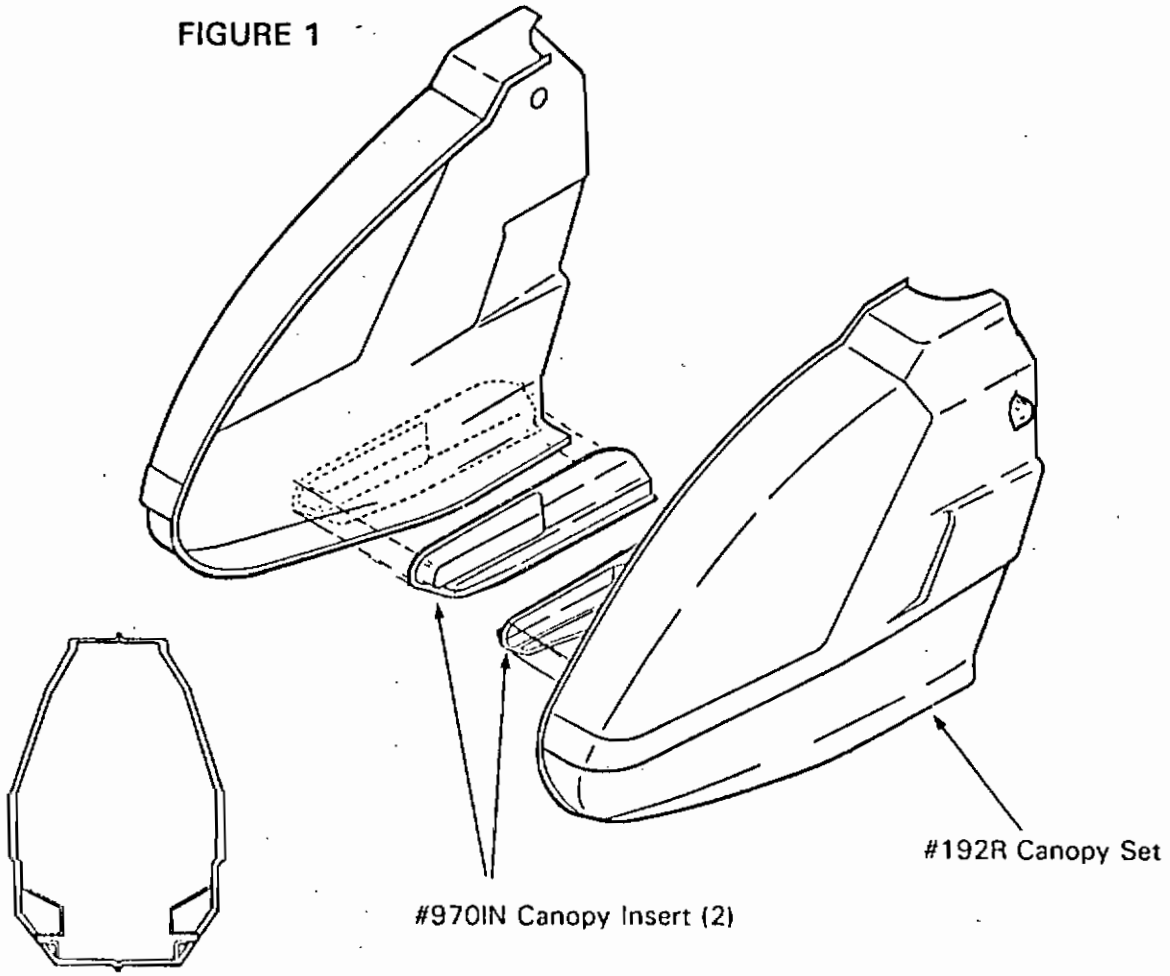
STEP 2 FIT ROTOR HEAD

Push the main rotor head onto the shaft and align the hole in the hub with the hole in the main shaft. Be sure that with the paddles facing the correct direction and the flybar control arm is on the same side as the carrier unit. Insert the 3 x 20 mm socket head screw (#234) fitted with a 3 mm flat washer (#276L) and secure with another 3 mm flat washer and a 3 mm lock nut (#243). Tighten firmly, but do not over-tighten.

STAGE 15 CABIN ASSEMBLY

IN BOX

FIGURE 1



STEP 1 TRIM CABIN

Trim the edges of the two cabin halves, leaving about 1/2" (12mm) of flange all around the edges to be joined.

STEP 2 FIT TOGETHER

Fit the two halves together and clamp with spring clothes pins or clips.

STEP 3 GLUE CABIN

Use a thin cyanoacrylate glue and carefully flow into the joint from the inside. Be careful to use only a small amount at a time. You will be able to see the joint fill with the glue as it 'wicks' around the whole joint. If you use too much glue, the joint will turn white - so be careful. Now trim the glued flanges to about 1/8" (3mm) wide, all around, using scissors and a sandpaper block.

STEP 4 FIT INSERTS

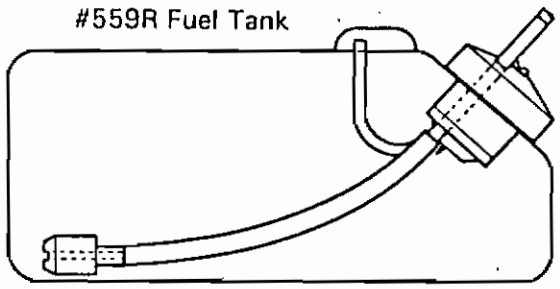
Trim the two slide inserts and glue into the cabin as shown. You will easily determine which is the right or left side since each part will only fit properly in its respective side.

STEP 5 PAINT

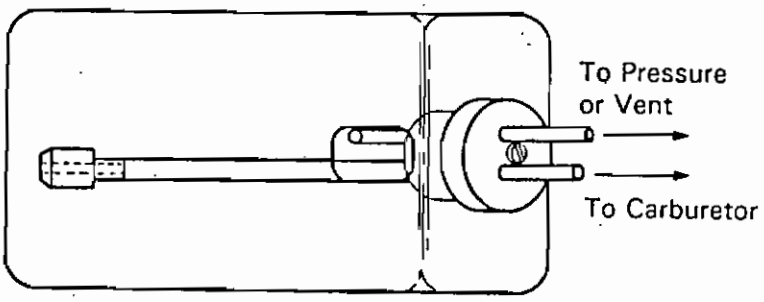
Mask, paint and trim the cabin in your favorite colors. We use white main color, the decals provided in the kit, and we tint the transparent red or blue.

STAGE 16 FUEL TANK ASSEMBLY

BAG #11



SIDE VIEW



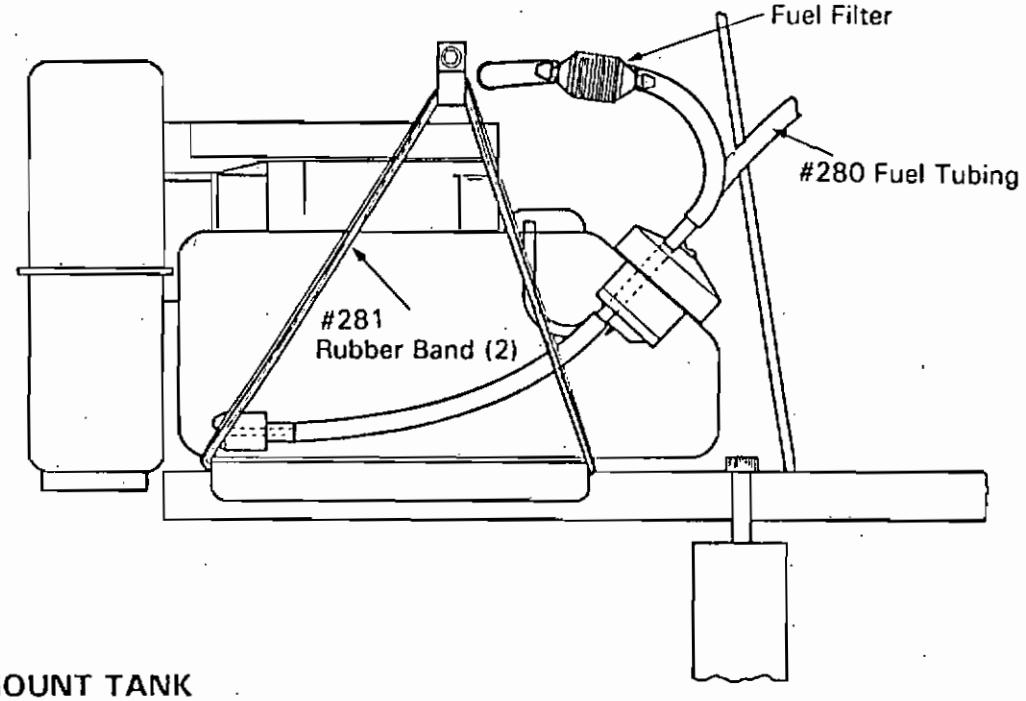
TOP VIEW

STEP 1 ASSEMBLE TANK

The fuel tank is a kit box item. It contains all the tubes and fittings you will need to assemble the tank unit. You should obtain a fuel filter from your local hobby store to use between the fuel tank and engine carburetor.

1) Remove contents of tank.

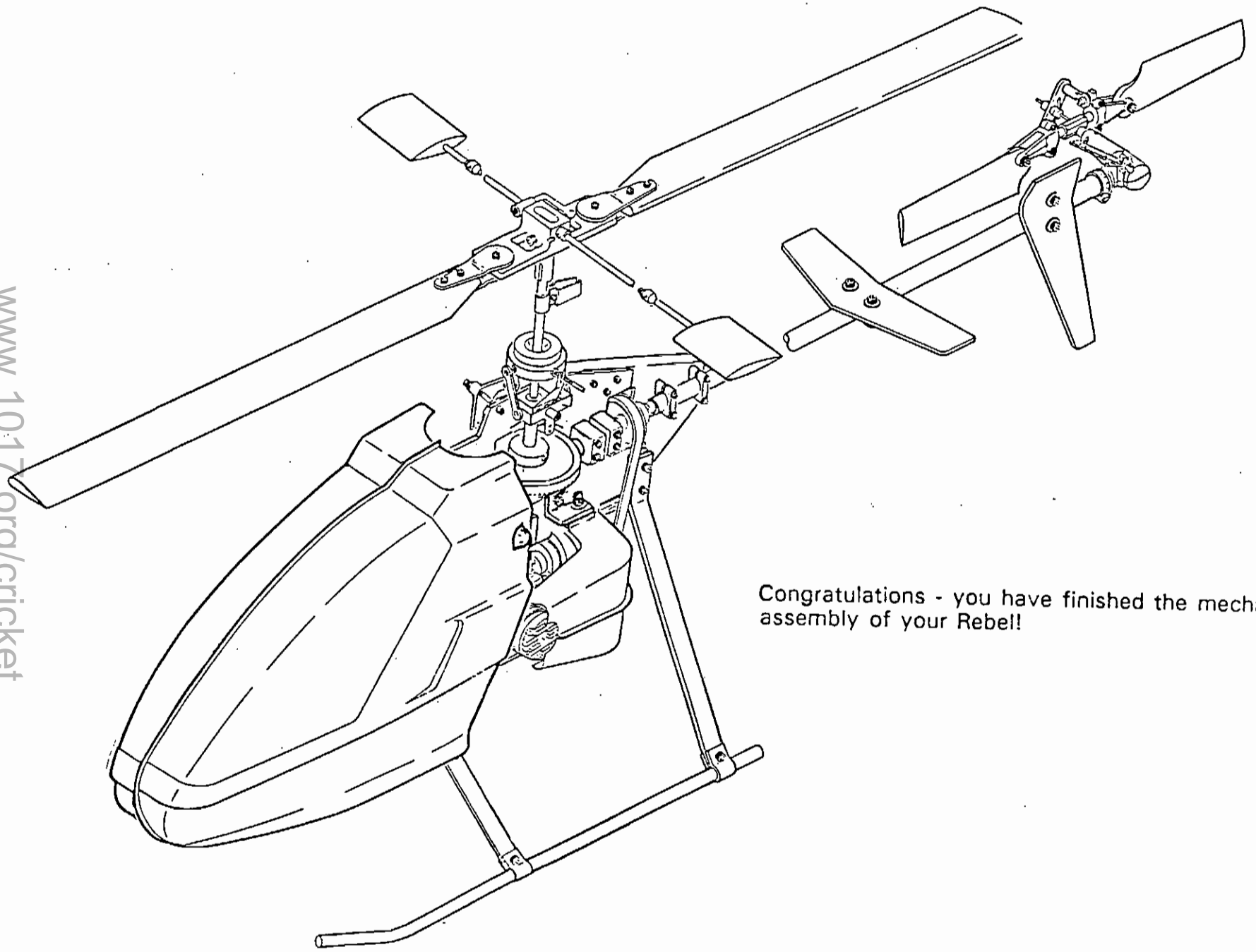
2) Insert two aluminum tubes into cap assembly consisting of a rubber plug sandwiched between a small inner plastic piece and an outer plastic cap, all of which are held together with the screw provided. Be sure that the screw head is on the outer cap. Do not tighten yet as this will expand the rubber and prevent installation. Use only two tubes (not three). The long one is for the vent and should be bent so that the end of the tube is very close to the top inside surface 'bubble' of the tank when the plug and cap are in place. Fit the other tube so that about 1/2" extends inside the cap. Connect a piece of the silicon fuel line to this 1/2" end and the clunk to the other end as shown. Make sure that the length of this piece of fuel tubing is long enough to allow the clunk to fall onto the floor of the tank by its own weight, yet not too long so as to position the clunk against the back of the tank where the fuel flow can be obstructed.



STEP 2 MOUNT TANK

Mount the complete tank onto the tank mounting plate on the right side of the helicopter with the tubing forward and the slanted edge up. Use rubber bands secured to the tank clip and mounting plate flange to hold the tank firmly in place. Connect the vent tube to the muffler pressure nipple of the muffler installed on your engine. Connect the other (feed) tube to the carburetor via a piece of fuel tubing with a fuel filter included in the line. Also, use the 1/4" hole in the main frame for running the feed line through the main frame to the carburetor.

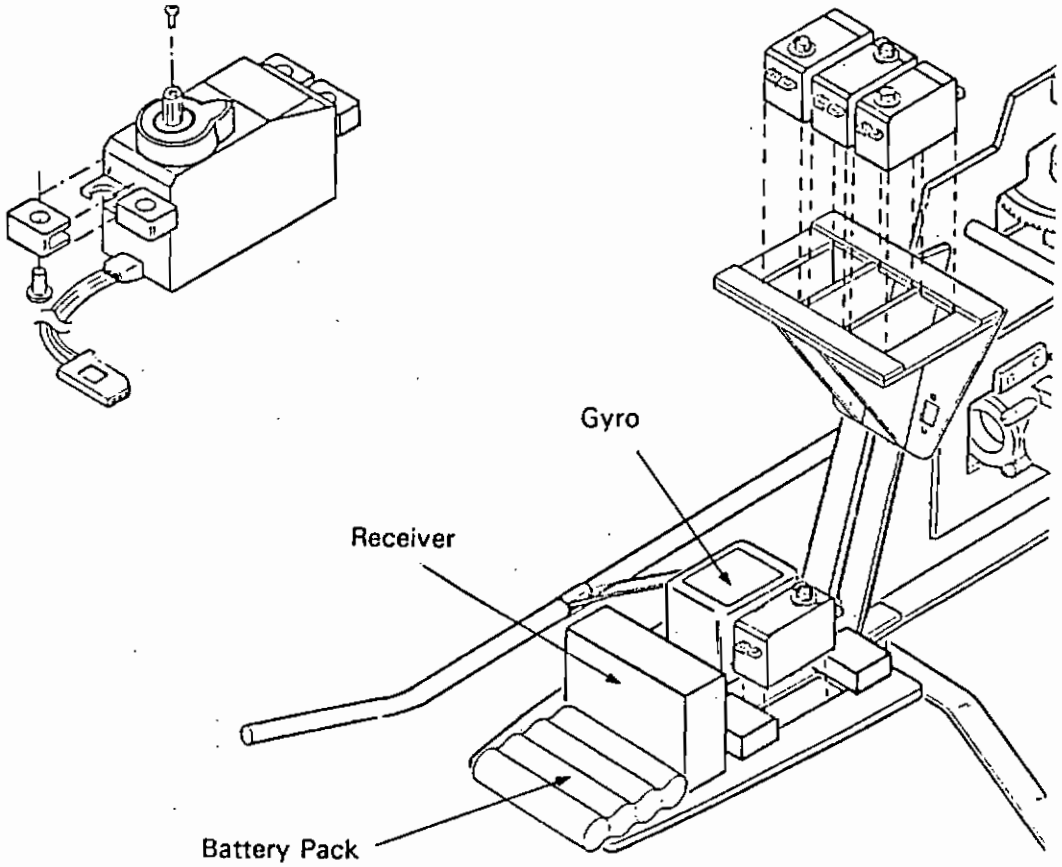
STAGE 17 FINAL MECHANICAL ASSEMBLY



Congratulations - you have finished the mechanical assembly of your Rebel!

STAGE 18 FIT SERVOS AND RADIO GEAR

FIGURE 1



STEP 1 PREPARE SERVOS

Prepare the four servos as shown, with the rubber mounts and the brass bushes. Since RC helicopters give the servos a lot of work to do and also vibration, use the highest quality servos you can. The use of a the lowest quality servo will show up in flight performance and poor reliability much sooner than when used in a model plane.

STEP 2 FIT SERVOS

Assemble your four servos into the servo mount as shown in Figure 1. Use the special screws provided by the radio manufacturer. Tighten the screws firmly so that your servos will not have any significant 'rock' when control is applied. Servos need to be more firmly mounted in helicopters than in airplane use.

STEP 3 MOUNT BATTERY AND RECEIVER

Fit the battery and receiver as shown. You should use 1/16" double sided tape for this purpose. Make sure that the battery is mounted as far forward as possible to ensure a correct 'center of gravity'.

STEP 4 FIT GYRO

The use of a gyro is highly recommended for learning to fly RC helicopters. This device senses and counteracts torque changes and wind gusts that adversly affect the tail rotor response making the helicopter 'squirrely' and much more difficult to fly. With a gyro the tail becomes 'locked' thereby allowing the pilot to focus more attention on the cyclic controls and throttle which undoubtly speeds up the learning curve!

The gyro and control box should also be mounted with 1/16" double sided tape, either onthe cabin floor or on top of the battery. Refer to the instructions provided with the gyro to make sure that it is properly installed both in the helicopter and to the radio.

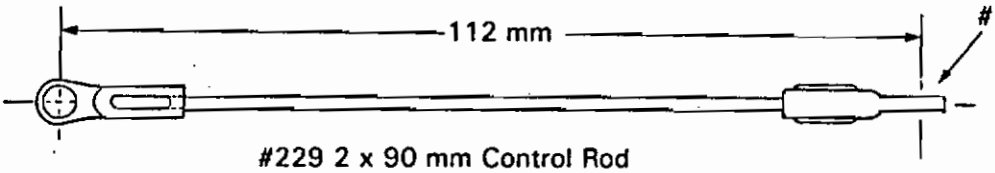
STAGE 19 CONTROL RODS

BAG #1 AND #12

STEP 1 ASSEMBLE RODS

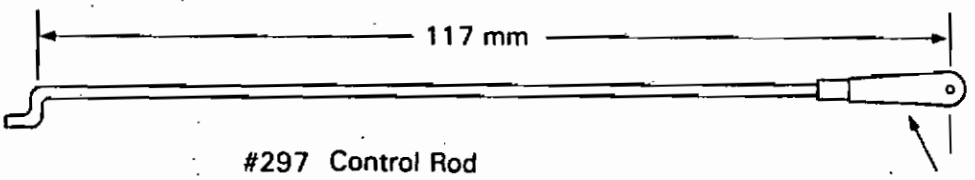
Make up control rods as shown below. The lengths shown will be very close to the finished lengths so set each rod accurately to the dimensions indicated.

CR 1
(1) Rotor Head



#229 2 x 90 mm Control Rod

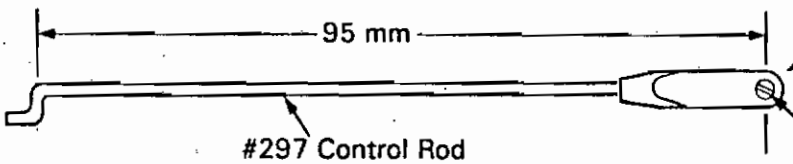
CR 2
(1) Pitch (Servo To Pitch Lever)



#297 Control Rod

#217 Clevis

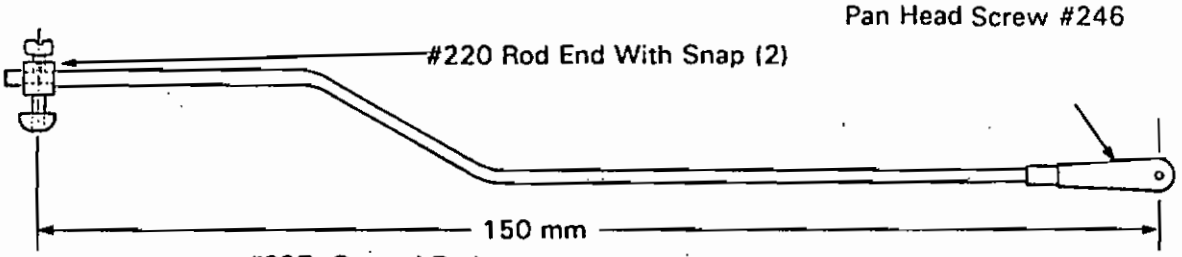
CR 3
(1) Roll (Servo To "L" Lever)



#297 Control Rod

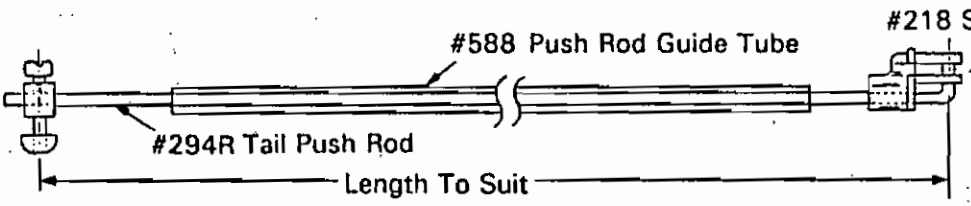
NOTE: For CR3 Only
Fasten with a 2X8
Pan Head Screw #246

CR 4
(1) Throttle (Servo



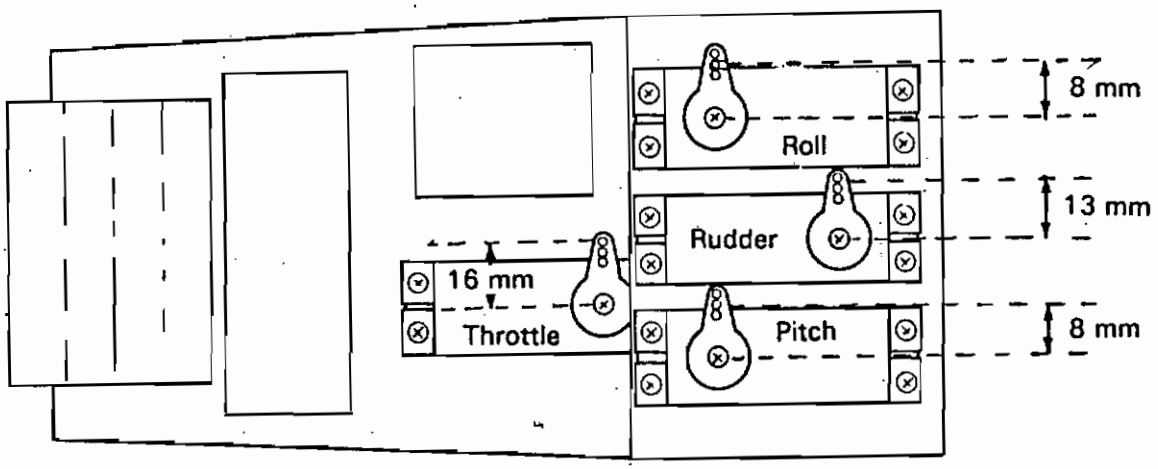
#297 Control Rod

CR 5
(1) Yaw (Rudder)



STAGE 20 CONTROLS - FIT RODS

FIGURE 1



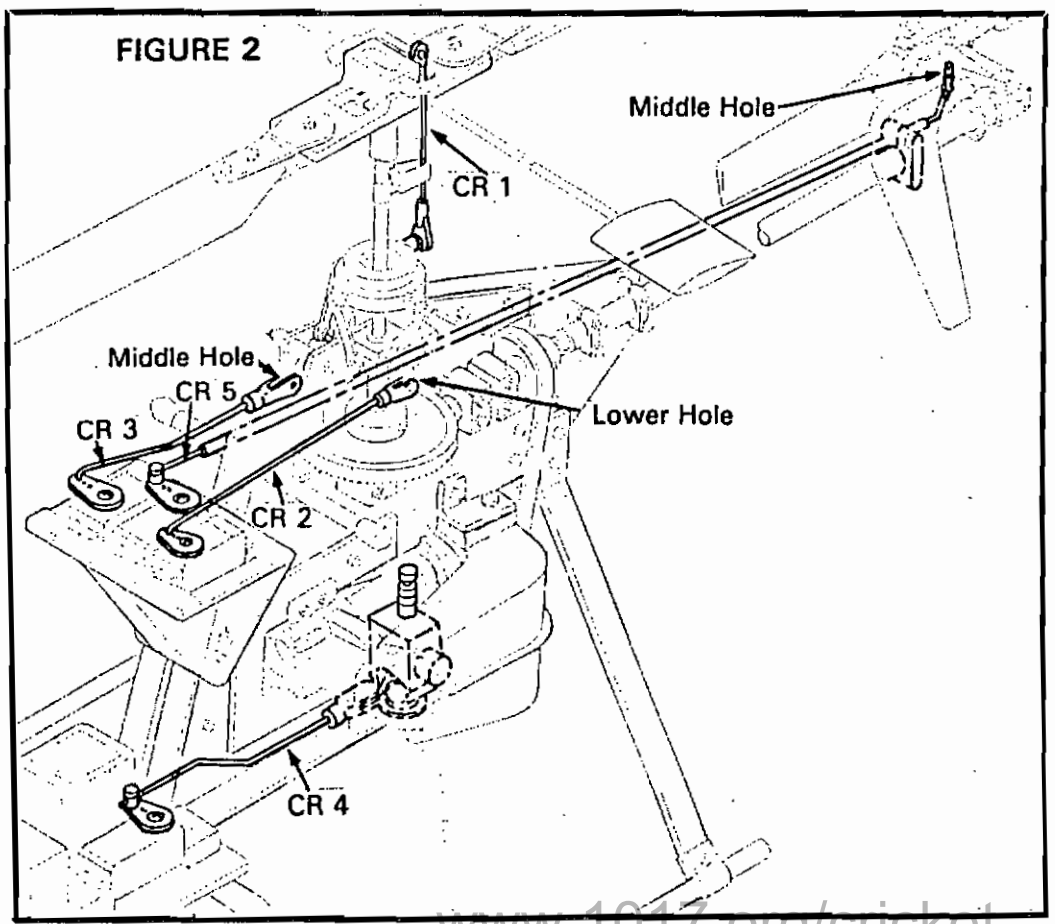
STEP 1 FIT SERVO ARMS

Temporarily fit the following servo arms in the following positions to each of the servos as shown in Figure 1. Your radio should be operational at this stage with the servo arms 'centered' as shown in Figure 1, with all transmitter controls at center or neutral position. The arm should be inspected for cracks before assembly to the servos.

STEP 2 CONNECT CONTROL RODS

Connect all control rods to their respective levers and servo arms as shown in Figures 1 and 2. Be sure to fit CR 5 inside the two tail rotor control clips (#154R) previously installed to the tail boom mounting plate (#199) in Stage 5 and the plastic mount (#455) in Stage 11.

FIGURE 2

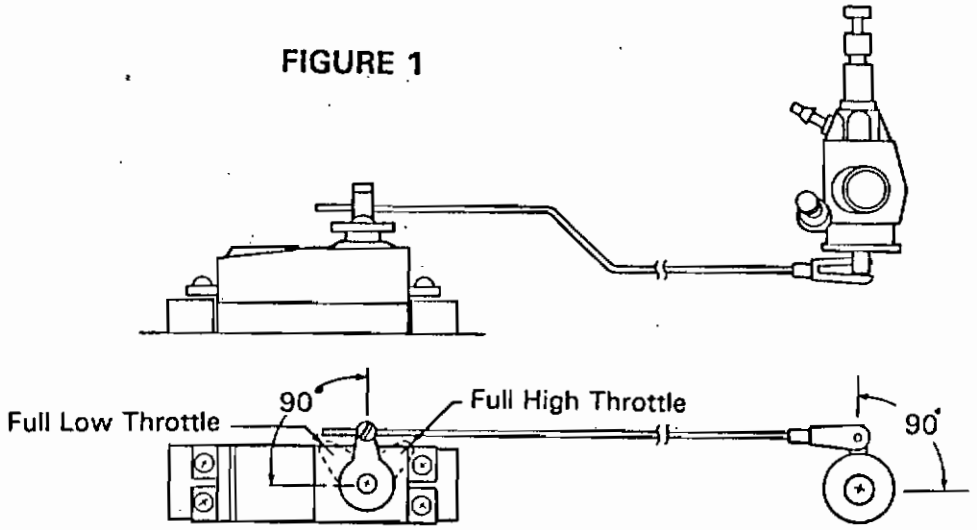


STEP 3 CHECK CONTROLS

Remove the servo end of each control rod in turn. Check freedom and range of control by moving each control function to the end of its travel, using only a light pressure, holding the rod end with your finger and thumb. If at all tight at any point, find the cause of the binding and fix it at this stage. This check is vital, not only to good flight performance, but also to the safety aspects of flying your RC helicopter. The integrity of your system is only as good as the weakest link. Make sure you do not have any. Recheck the above step frequently, after every flying session is a good idea.

STAGE 21 SET-UP CONTROLS

FIGURE 1



STEP 1 THROTTLE SERVO SET-UP

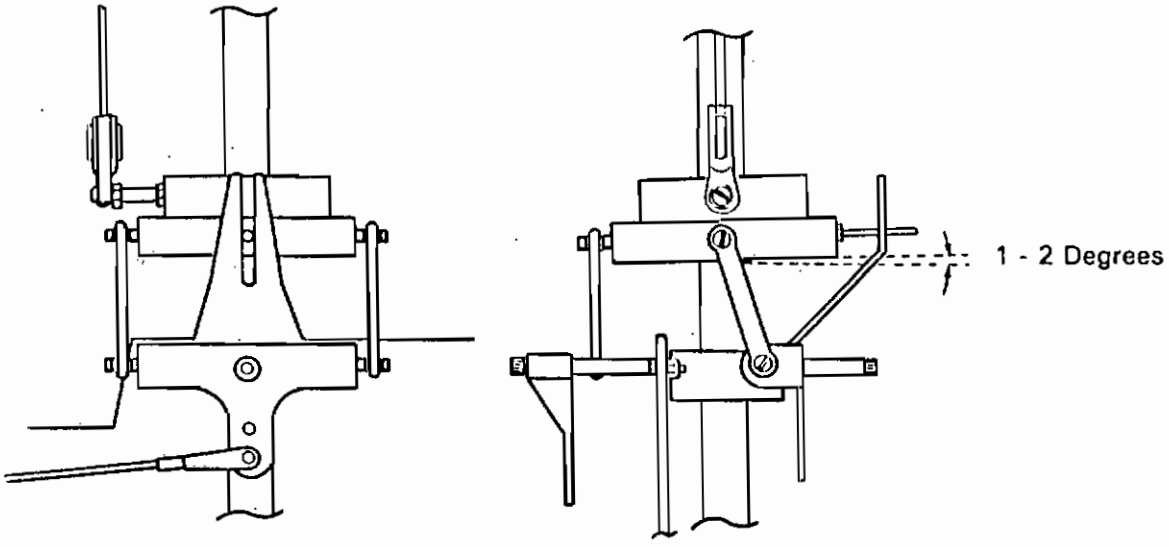
Set trim at full and stick at mid position. The servo arm should be perpendicular to the servo case and the carburettor lever at 90 degrees to the control rod, as shown in Figure 1. Adjust length of throttle and of servo arms so that at low throttle, low trim, the carburettor barrel is just fully closed* and at full throttle, full trim, the barrel is just fully open. At half stick, the barrel should be about half way open. If you are unsure which transmitter stick controls the throttle, refer to Figure 1 on page 35.

* This is important in a model helicopter since it has the only safe way to stop the engine and rotor blades except to run out of fuel.

Throttle stick	BACK	BACK	FWD
TRIM	BACK	FWD	FWD
Throttle Barrel	Closed	Idle	Open

Note: The Stick and Trim movements indicated refer to FULL movements

FIGURE 2



Side View

Front View

STEP 2 ROLL (AILERON) AND PITCH (ELEVATOR) SET-UP

Adjust the lengths of the roll and pitch rods so that at neutral trims, the swashplate is level fore and aft and tilting one or two degrees to the right for roll, as shown in Figure 2.

STAGE 21 SET-UP CONTROLS (CONT'D)

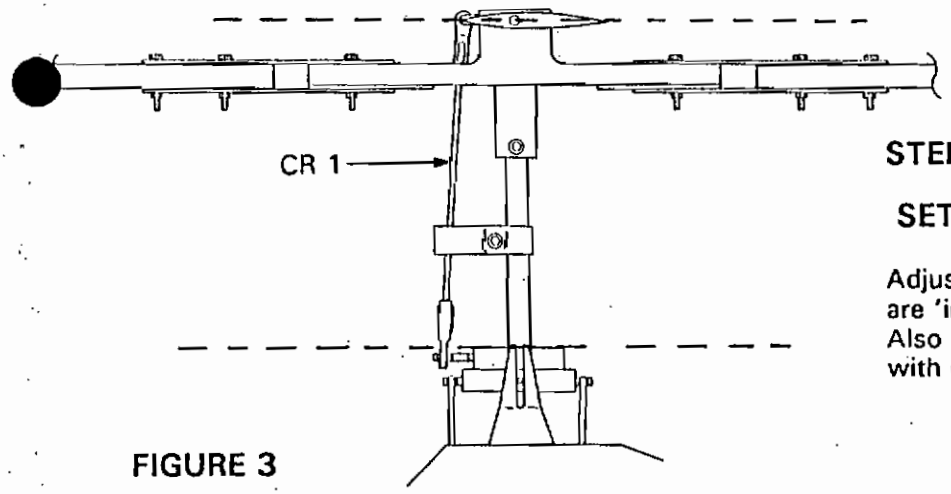
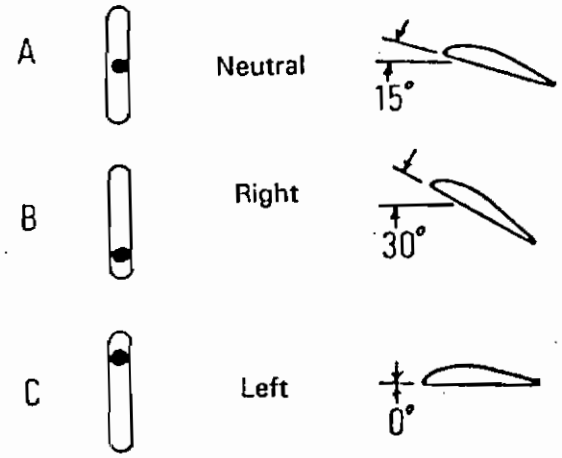


FIGURE 3



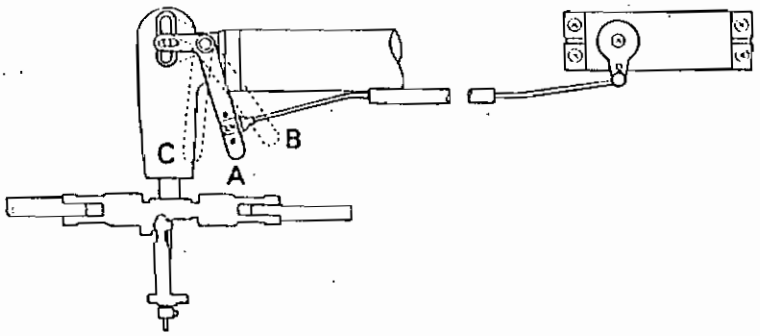
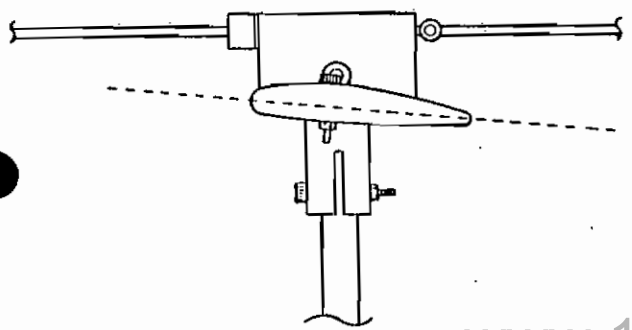


FIGURE 4



STEP 3 ROTOR HEAD CONTROL

SET-UP

Adjust the length of CR 1 so that the paddles are 'in line' with or parallel to the swashplate. Also make sure that the paddles are 'in line' with each other.

STEP 4 TAIL ROTOR CONTROL

1) Set the tail rotor (rudder) servo arm at neutral position and then the length of the control rod should be adjusted at the servo until the pin in the gearbox slot is centered, as shown in Position A of Figure 3. Now, without affecting the settings achieved in "A", check to make sure that with full left or right rudder stick movement and corresponding left or right trim, and ATS on (if using a helicopter radio), the pin moves nearly (say, 90 degrees) the full amount of the movement that the slot will permit, as shown in positions "B" and "C" in Figure 3. Now set the collars which position the pitch control plate on the pitch control wire so that with neutral stick the blades have approximately 15 degrees pitch, as shown in position "A" of Figure 3. Full right and left stick positions are shown in positions "B" and "C" respectively. This is an initial set-up and may need to be varied during flight set-up. Maintaining a central setting of the pin in the slot should always be observed so that full throw will always be available to you.

STEP 5 FIXED PITCH SETTINGS

On most RC helicopters the pitch of the main blades must be carefully adjusted for proper performance. However, due to the innovative design of the Rebel rotor head, the blades, if assembled to the blade holders correctly, should already have the correct pitch! Look down the ends of each main blade toward the rotor head. The orientation fo the blade to the flybar should be as shown in Figure 4.

FINAL ADJUSTMENTS AND LEARNING TO FLY

The Rebel helicopter has been designed to be a high quality yet simple, low-cost and enjoyable RC helicopter. It has also been designed to be very stable and easy to fly...ideally suited for the beginner.

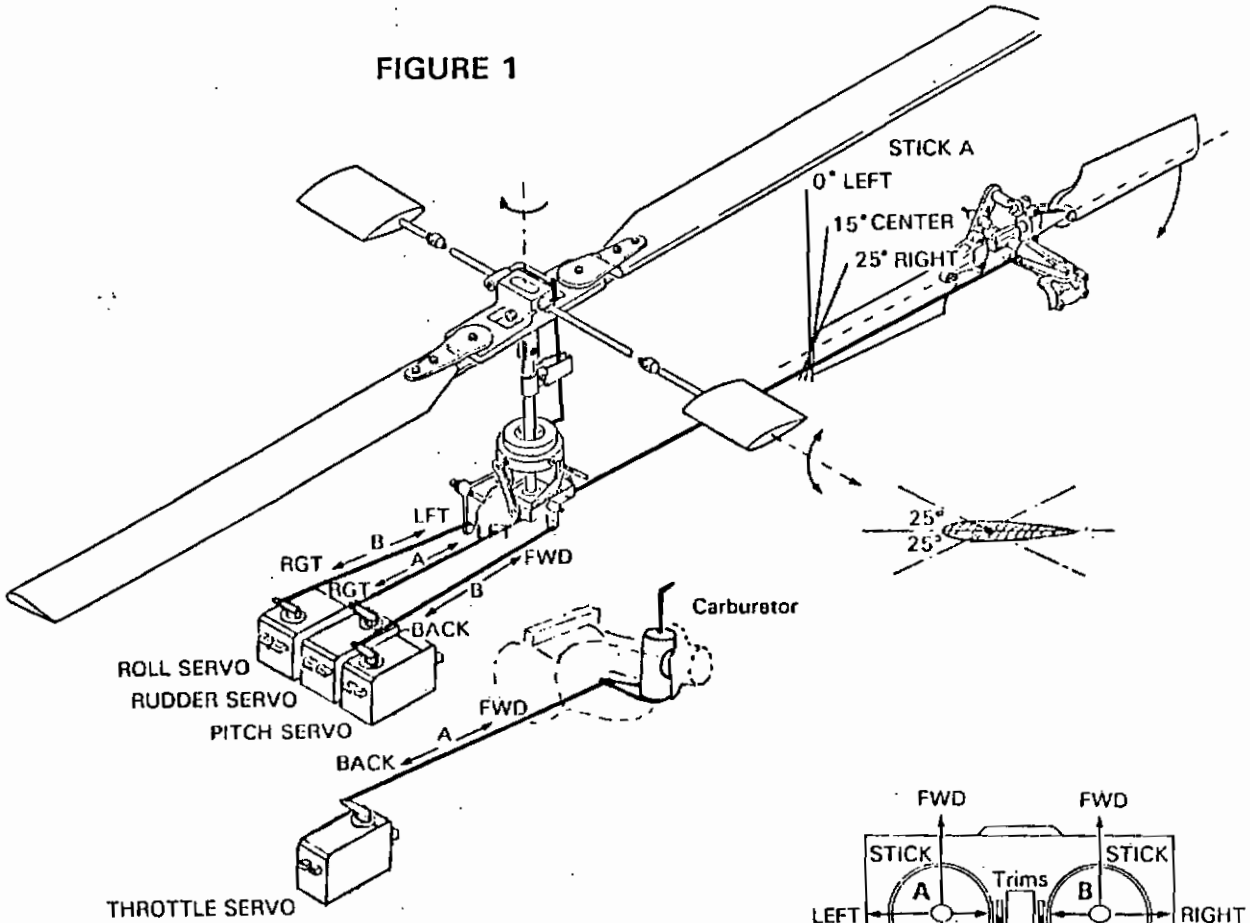
After many hours of research, development and flight testing, we designed the Rebel's unique one-piece flapping rotor head. This new rotor head coupled with the specially designed main rotor blades provide sparkling flight performance very similar to collective pitch helicopters. Rebel has much improved altitude control compared to other fixed pitch helicopters which tend to 'float' on descent. Thus the extra complexity of collective pitch, bell hiller mix, ATS compensation, special radios, etc. has been avoided for the entry level flier.

While the Rebel is extremely stable and docile, it is also very responsive. Fast and slow forward flight is within the Rebel's repertoire as are stall turns, loops and rolls. Keep in mind, however, that the Rebel was designed as an unsurpassed training platform for the beginner and naturally is not fully 'aerobatic'. While an accomplished flier will be able to loop and roll the Rebel, it is not generally recommended for the beginner flyer since the helicopter will be operating on the edge of the flight envelope for which it was designed. Therefore, we recommend that you regard the Rebel as a low cost, easy to maintain, easy to fly, very reliable fun machine for you to explore the fascinating world of RC helicopter flight.

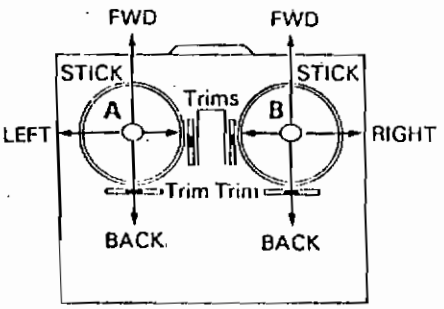
Now that your Rebel has been completed and most of the major adjustments have been made, it is time to finalize and check some of these adjustments before starting the engine and commencing your flight training.

First, check to be sure that each stick movement on the transmitter moves the appropriate control function in the correct direction and amount as shown in Figure 1.

FIGURE 1



STICK A	BACK	BACK	FWD
TRIM	BACK	FWD	FWD
Throttle Barrel	Closed	Idle	Open



MODE 2 TRANSMITTER

Note: The Stick and Trim movements indicated refer to FULL movements

Now, check the pitch angles of your main blades again. It is very important that both blades are set at the same angle, relative to the flybar, with the leading edge higher than the trailing edge. The flybar will try to maintain the horizontal plane of the rotor disk due to centrifugal force, leveling it out. The lift generated from each of the main blades, therefore, will be proportional to their respective angles to the flybar. Although the Rebel blade holders are preset for the proper pitch settings, minor adjustments may be necessary during flight testing to maximize flight performance and minimize vibration.

Now check the swashplate settings again but first make sure that the paddles are set in-line with each other. That is to say, zero to zero angle between the paddles looking end on. Also check, by looking end on at the paddles, that they are parallel to the swashplate. As mentioned earlier, the swashplate should be level in pitch but tilted a little to the right for roll when looking from the rear of the helicopter. This right hand tilt is there to offset the left hand sideways forces created by the tail rotor (Something like the right thrust setting used on model planes).

Because of the extreme importance, we must again emphasize that you check all the connections between the servos and flight controls for smooth but positive movements as any friction or interferences in the control systems can cause the helicopter to fly poorly even to the point of being unstable and hence, dangerous. An easy way to check this is to disconnect each control rod in turn from its own servo and move the rod with your finger and thumb. It should move smoothly and easily.

You should also check to make sure that all of the nuts and bolts on the helicopter are tight and that the radio gear is securely fastened to the cabin servo tray.

If you have fitted a yaw gyro, now is the time to check that it's operation is correct. By moving the tail of the Rebel quickly to the right, the gyro will sense and counteract this movement by initiating a servo response so that the pitch of the tail rotor blades increases or, in other words, so the rudder servo pulls on the tail rotor pushrod. The opposite should happen when you move the tail to the left. If for some reason the gyro is working in reverse of the previous description, there are two things you can do. First, many gyros on the market today have a reverse switch for such a situation. If your gyro has this switch, use it to solve the problem. If, however, your gyro doesn't have this switch, you can mount the gyro upside down to achieve the desired effect.

One final setting that we have not discussed before is that of the center of gravity (CG) of the helicopter. Please, before you fly, make sure that the CG falls exactly on the main shaft or slightly ahead of it. There are several ways of checking the CG. One natural reaction is to hold the helicopter up by the flybar, with the flybar set to be 'across' the helicopter, and notice if the helicopter tilts forwards or backwards. This does not show the position accurately. A better way to check the CG is to straddle the helicopter with your hands, put your forefingers underneath the main gear edge (exactly opposite each other) on the outside of the helicopter. Position your fingers so that they are in line with the main shaft and then lift the helicopter. You can then, by moving your fingers forwards or backwards, accurately locate the CG. Adjustments can easily be made by moving around the battery pack, or by adding a small amount of lead ballast (secured properly with epoxy glue or silicon).
Rebel's fuel tank has been designed to be very near the center of gravity of the helicopter. This is the best place since the center of gravity will not vary as fuel is used during flight and, consequently, trim adjustments will be minimized.

At this point, you should consider whether you want to use "training wheels" with your REBEL. "Training wheels" attach to the bottom of the landing skids of the helicopter and widen the landing base. The advantage of a wider landing base is that tip-overs, which can damage your REBEL, are virtually eliminated. However, a disadvantage is that "training wheels" add to the overall weight of the helicopter which may cause a deterioration in flight performance if the engine power is marginal.....as a general rule - the lighter they are, the better they fly! Keep in mind that REBEL's unique landing gear was designed with a wider base than most other 'trainer helicopters'. Thus, tip-overs are minimized. In fact, many average flyers have learned to fly without training wheels with no tip-over problems. If you have installed a new or slightly used 40 size or better engine and want the added security, go ahead and install the GMP Training Wheels #615 to your REBEL while you are 'getting the hang of it'. Once you feel comfortable with the flying characteristics of the REBEL and can hover under complete control, the "training wheels" can be removed.

It is a good idea to refer to a check-list when first learning how to fly. The beginner often gets so "caught up" in learning how to fly that key safety and equipment checks are overlooked. The following check-list should be cut-out and kept in a visible position in your flight box and refered to before every flight.

HELICOPTER PRE-FLIGHT CHECK LIST

1. Always include a fuel filter between the tank and engine to ensure a consistent engine run. Also, filtering the fuel from the fuel storage is an added safety feature.

2. Be sure to refuel before every flight and keep an eye on the fuel level to avoid a flame out which would result in a very hard landing!

3. Make sure your radio is operating perfectly before take off and the batteries are always fully charged before a flying session. (Refer to radio instruction manual for proper charging and battery information).

4. Regularly check all screws and nuts for tightness.

5. Always fly in an open area away from people and houses.

6. Even when you become more confident and proficient. Always hover briefly after take-off as a final check on everything before going into forward flight.

7. Don't ever fly with rotor blades that have been damaged from a "tip-over" or "hanger rash". They may look fine, but may have hairliine cracks under the blade covering. Flying with such rotor blades can lead to certain destruction of your helicopter and the risk of injury to yourself and others.

8. Don't get too close to the model when hovering, we know it's fascinating but, those blades are dangerous!

9. When flying, if anything appears abnormal such as a change in engine noise, change in handling characteristics, a vibration noise that wasn't there before etc., land and check.

10. Always clean the model thoroughly with a 'windex' type of cleaner after each flying session. A build up of oil and dirt is bad modelling practice

You are now ready to start the engine and make flight adjustments.

TRIMMING AND FLYING

Try and find a quiet spot, certainly away from pets and children, and a smooth surface such as concrete or asphalt. Have somebody with you when you are testing a helicopter in case there is an accident and you need immediate assistance.

Now, follow the engine manufacturer's instructions to set the idle and the top end carburettor adjustments of your engine. With a new, non- ringed engine, it is advisable to have at least half an hour of bench running. This will also help you to familiarize yourself with the carburettor settings of your engine.

Use a fuel containing about 10 - 15% nitro and, if you wish to ensure a slow 'break in', use some Castor oil in your fuel. Start the engine with the main throttle lever at its lowest setting and with the transmitter idle trim at full. The engine should run at a 'fast idle'. The clutch will engage at around 1,500 RPM. It cannot be stressed too highly that when starting the engine, and until you are actually ready to hover the helicopter, THE ROTOR HEAD MUST BE HELD FIRMLY IN ONE HAND. If you watch any expert flying his machine, you'll see that he does this and it is simply to cover all of the possible cases of the engine being started at full throttle by accident, or your radio not being switched on, or somebody else's radio interferring with yours, or a link is missing from your helicopter, etc. Any one of a number of things could cause the engine to start at high speed and, if you are not holding the rotor head firmly, then the helicopter, at best, could start off violently and hurt you or anybody near. At the worst, it could take-off, out of control, and unless you were able to regain control quickly, you would lose your helicopter and possibly hazard other people's property or even life. So please observe the 'Golden Rule' for all good helicopter flyers - - - HOLD THE ROTOR HEAD FIRMLY WITH YOUR HAND ALL THE WHILE THE HELICOPTER IS NOT ACTUALLY IN POSITION FOR FLYING! And, as soon as the helicopter has landed and the blades have come to rest, hold the head again firmly before you do your shutting-down of the engine! And never air-taxi out from the pits or near people, animals or property!

So now on to the first phase of learning to fly.

There certainly are some flyers who are so well coordinated that they can hover a helicopter successfully after a very few attempts. These people fall in the same category, we believe, as those fixed wing flyers who can take-off, fly around and land fixed-wing planes with little or no effort and in a very short time. This section of the "Rebel" manual, however, is intended for the 'average modeler' who eventually has a heck of a lot of fun flying model aircraft, but takes a little time (and effort) to achieve this result. So, unless you possess more than average coordination, or you have a lot of money and time, we offer the following method of simplifing the process and learning to fly with little or no damage to your machine and your ego.

Now, learning just one function at a time is really impractical unless a training rig to 'tether' the helicopter is used. Learning the functions two at a time, however, is quite easy and many people have learned (with no damage to the helicopter) in this way.

So why not try the one hand (two function) at a time method?

One pre-requisite to learning, in any event, is to have a well trimmed helicopter. Even an experienced flyer, if the helicopter is not trimmed, can find it difficult to maintain a stable hover, and you will normally find that the experienced flyer will land the machine again, several times, after very short experimental lift-offs, if necessary, to get the trim right. So, before you learn to hover, it is extremely important to seek the help of an expert or a reasonably accomplished flyer, if one is available in your vicinity, to hover your helicopter for you and to make sure that it is properly and accurately trimmed. The tail and the speed of the main rotors at lift-off must be correct. The 'tracking' of the blades must be right, the helicopter drive elements and engine must be running smoothly and well, and the helicopter should have very little 'shake' on the tail boom or the landing gear. If all of these things are not correct, then don't continue. Once the helicopter is in trim and running smoothly then, and only then, should you commence your learning to hover. If the drive elements are not operating properly, re-check all the clearances and settings. If the blades are 'out of track' and you do not have any expert help available, then you should proceed as follows:

FIRST WE MUST STRESS THAT YOU SHOULD NOT, REPEAT NOT, TRACK YOUR MAIN BLADES BY HOLDING YOUR HELICOPTER BY THE TAIL BOOM WHILE LIFTING IT INTO THE AIR. THIS IS AN EXTREMELY DANGEROUS PRACTICE AND IS STRONGLY DISCOURAGED BY GMP.

However, tracking the blades is certainly a difficult procedure for the beginner since it requires the actual hovering of the helicopter for a short period in order to be able to observe which blade is higher than the other. We will, however, describe this procedure for you and, even if you can not observe the blades yourself, you should try to lift the helicopter to a hover just for a second or two while a friend or somebody else kneels down, at a safe distance of course, and observes the 'tracking'. If your Rebel spins sharply in one direction or the other, please check that your gyro sense is correct. A reverse sense gyro can cause serious problems to the machine and those around you. Also check that your tail rotor drive shaft is not slipping. A certain indication of this is if the helicopters nose rotates to the left. So, if there is any doubt about this, stop your engine and check that the gyro causes the tail blades to move in a direction to oppose the 'yawing' of your helicopter.

TRACKING BLADES

'Tracking' is a measure of the lift of each of the blades, which should be equal. If the lift of one blade is greater than the other, then the tracking is wrong and there will be vibration and a loss of control. The tip of one blade must be marked with a piece of colored vinyl or Monocote during the building phase and the idea behind this will become apparent now. If you look at the edge of the blades while they are running and the helicopter is just lifting off the ground, you will notice that if the blades are tracking you will see only one blade at the tip, but if they are not tracking you will be able to clearly see one blade higher than the other. Because the blades are marked individually you should then be able to judge which of the blades is the higher. Now, to correct this tracking, you must change the pitch of one of the blades.

Before we do, however, we should also note one other factor and that is that the main blade speed of Rebel should be around 1,600 RPM at lift-off with a throttle setting of about half. If the speed is higher than this, then in order to adjust the tracking, we should INCREASE the blade pitch angle that is lower of the two. If Rebel's blade speed is lower than 1,600 RPM, then we should decrease the pitch of the blade which was higher. This means that by adjusting the pitch of one of the main blades we can make one blade run higher than the other, or by adjusting both together we can lower or raise the rotor speed of the helicopter.

If you are a beginner into RC helicopters, you probably will not have a 'feel' for the rotor speed as this is gained through flight experience. Consequently, it will be very difficult to determine the actual rotor speed. The following tips will help in achieving this most important adjustment. If you find that you need much more tail blade pitch angle than has been suggested in the instructions and the helicopter's nose is always trying to turn to the left, then you are probably running with too much pitch on the main blades. If, however, you find the helicopter blades are running very fast and the nose always appears to be wanting to go the right, then you are probably running with too little pitch on the main blades. Adjusting the pitch of the blades is most easily done by utilizing two wrenches to 'twist' the blade holders slightly. Care must be taken to avoid applying any twisting force on the nylon rotor head itself as this could damage it. Once this adjustment has been made it should not need to be

repeated unless new rotor blades have been installed.

Another adjustment is to note that your high end throttle adjustment (needle valve) should be set so that the engine is on the verge of running rich (occasional four-cycling or 'burbling') until the helicopter has lifted off. Even in the hover, your engine should still 'burble' occasionally.

So now that we have all the setting of the radio, controls and blade angles correct, and your helicopter will be running smoothly with no visible 'shakes' in the landing gear and/or tail. If, however, this is not the case, then try the following balancing technique. Add a small strip of adhesive vinyl tape (about 1/2" x 3") to one of the main blades (any one-you choose).

If this causes the helicopter to shake more, you chose the wrong one. Take the tape off and add a piece to the other blade. If this reduces the shaking, then add more tape until the vibration disappears. If after several attempts the vibration reduces but you can't quite get it to a zero level then commence balancing across the flybar axis. This is done by moving the flybar weights, moving one of them in or out on the fly in 1/4" increments, until the vibration is at a minimum level. By using these two techniques, you should be able to reduce 'shaking' of your helicopter to zero or at least a very low level.

Once you have achieved a smooth running helicopter, you can begin to learn how to hover!

Place the helicopter on a smooth and level surface and start the engine. Stand back and to one side, about 6-10 feet away from the machine. The reason for this is that you will now have the best view of the fore-and-aft and side-to-side movements of the helicopter if you are looking at it from 45 degrees. For instance, if you stand directly behind the helicopter, then the fore-and-aft movements are harder to detect. The secret of accurate hovering is to make control inputs at the instant that the helicopter starts to move and maximum anticipation is helped by the best and earliest visual information.

Now, take a deep breath and try to relax. Run up the engine with the throttle lever until the helicopter is 'light on its skids', so that it apparently weighs perhaps only a pound or less instead of its normal weight. Under these conditions it is then quite easy, by using the transmitter tail control stick, to move the nose of the helicopter to the right and to the left, back to the center again, to the left, to the right, back to the center again. All the while you are doing this you will make small adjustments in throttle in order to keep that one pound of weight constant.

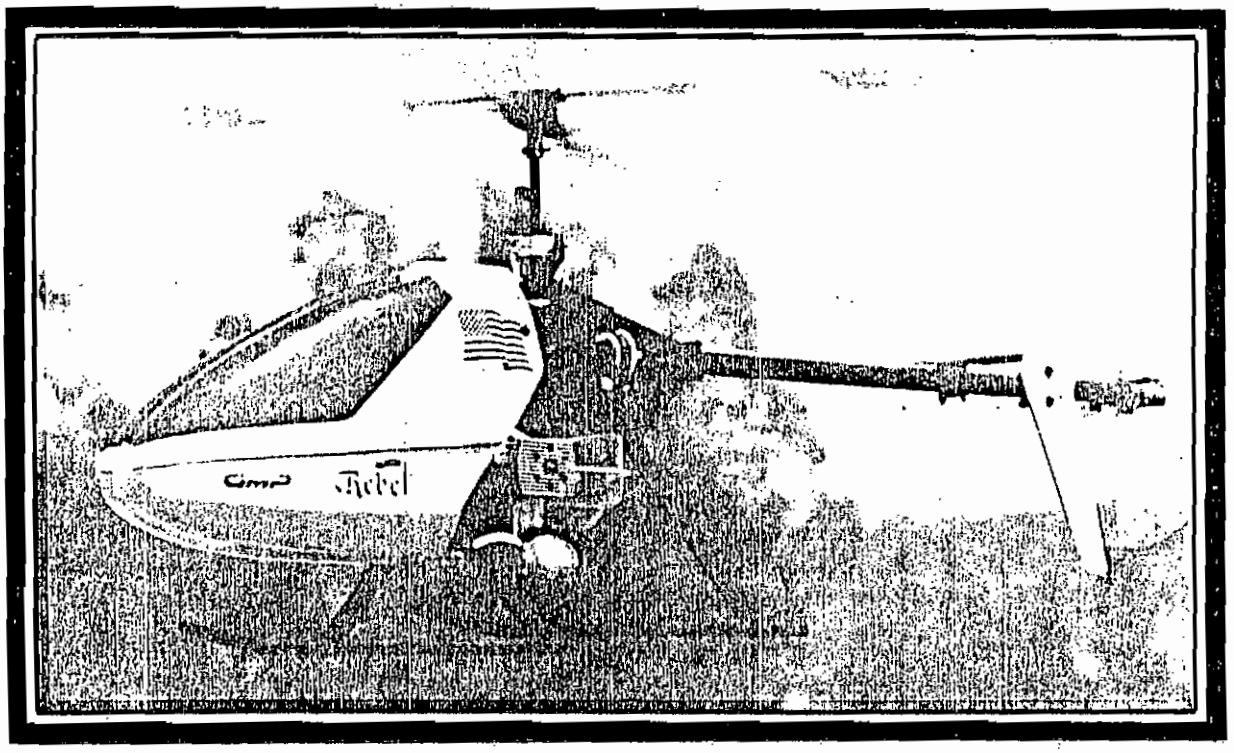
Soon your reflexes will learn how to coordinate the sideways movements of your left hand with the movements of the helicopter rotating to the left and to the right and the up and down movement of the left hand to vary the 'lift' of the helicopter. Do not make any right hand or cyclic movements when practicing this exercise.

It's hard to say how long you should keep up this practice, but certainly you should continue until you can do it without feeling strained during and after each session. When your left hand has been trained to keep the tail straight and the altitude constant, you can now comence to learn coordination of the helicopter's lateral movements with your movement of the right hand stick. So now the next step is to open the throttle so that the helicopter rises in a positive manner to a position between 1 and 3 feet off the ground. It's hard to believe this when you first begin to learn, but if a hovering helicopter is well trimmed and adjusted, there really is plenty of time to maintain, or to correct, the helicopter's movements sideways, backwards and forwards.

An analogy which reflects this argument and that beginners seem to understand is that you can regard the helicopter as a large balloon floating a few feet off the ground. The balloon can wander around as a result of small gusts of wind from different directions. We can keep the balloon stationary in front of us by 'patting' it at the right place and at the right time. If it moves away from us and we pat it towards us it may need another pat to stop it coming and position it where we want it. Except, of course, it will drift off again after a short while and we will have a continuous task of providing the right control inputs to keep the balloon stationary in front of us.

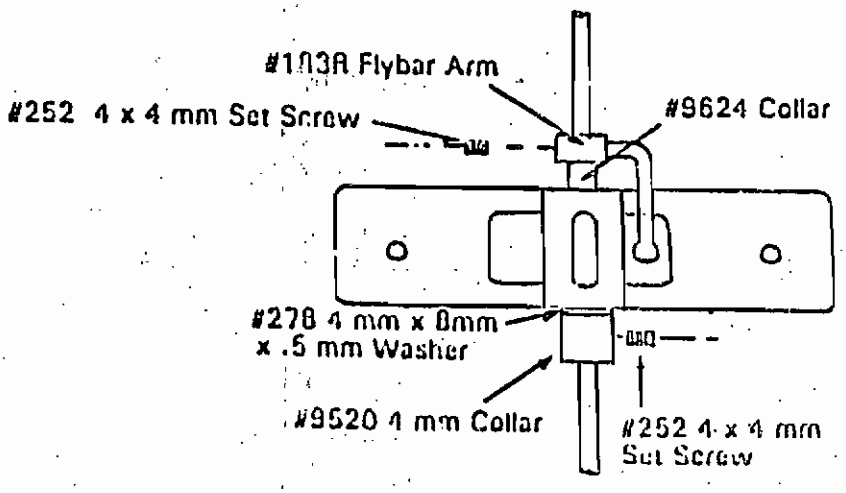
Once you have learned to fly the helicopter, then the 'pulsing' will blend into smooth, but still very small control commands. However, at the early stages, remember to think of the helicopter as a balloon which, let's say, is drifting towards you. You 'pulse' the stick towards it, you pat it back. As it starts to drift back, you'll need a small input in the opposite direction to pat it and stop its motion so that it settles in the spot that you want it. Don't forget that you can start a helicopter moving in one direction with the force produced by the right hand stick but you will probably, unless you have given exactly the right force at the right time, have to give an opposite force in order to slow it down and to settle it in the position required. Please remember that the foregoing applies only when the helicopter is well designed and, most importantly, well trimmed.

So try these hovering techniques and see if it doesn't help to speed up and ease up the learning process. Make each 'flight' only a few seconds and then land. Each successful 'flight', however short, will place you higher up the learning curve. We have seen people learn by this method and be hovering confidently for five to ten seconds at a time in less than a single morning. So don't give up - you can fly an RC helicopter if you really want to. Good luck with your hovering sessions. GMP has an excellent video tape which covers learning to hover and flying around slowly (GMP part #630).



GMP taking R/C helicopters to new heights!

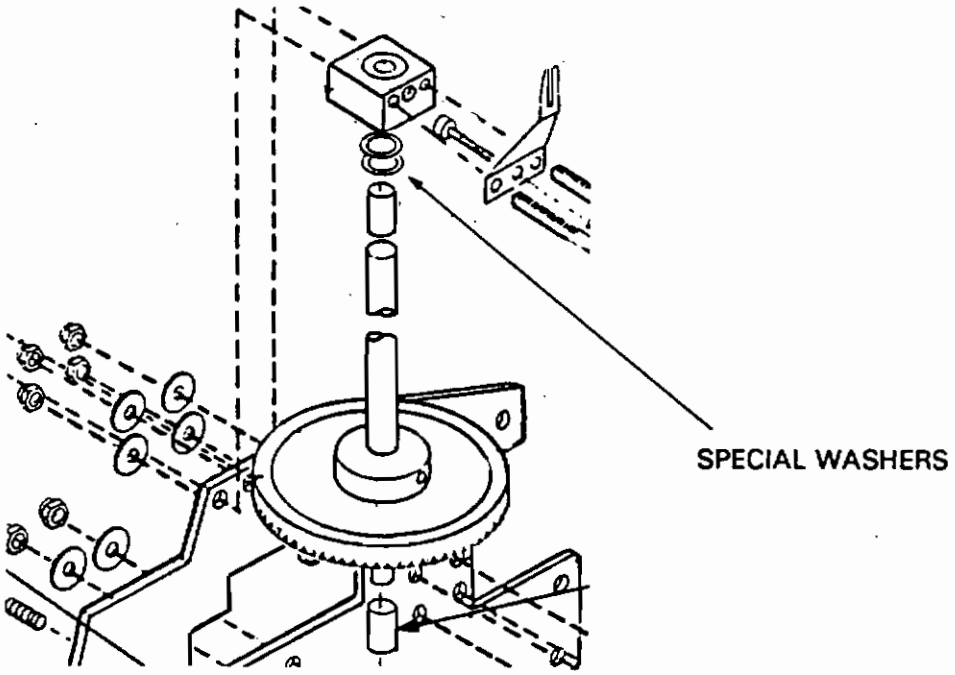
ADDENDUM TO STAGE 9 ROTOR HEAD ASSEMBLY



IMPORTANT!

In place of the 4 x 8 x .5 mm washer (#278) that mounts on the same side as the flybar arm (#183), use Collar (#9624) as shown to center the flybar arm ball

ADDENDUM SHEET TO STAGE 4

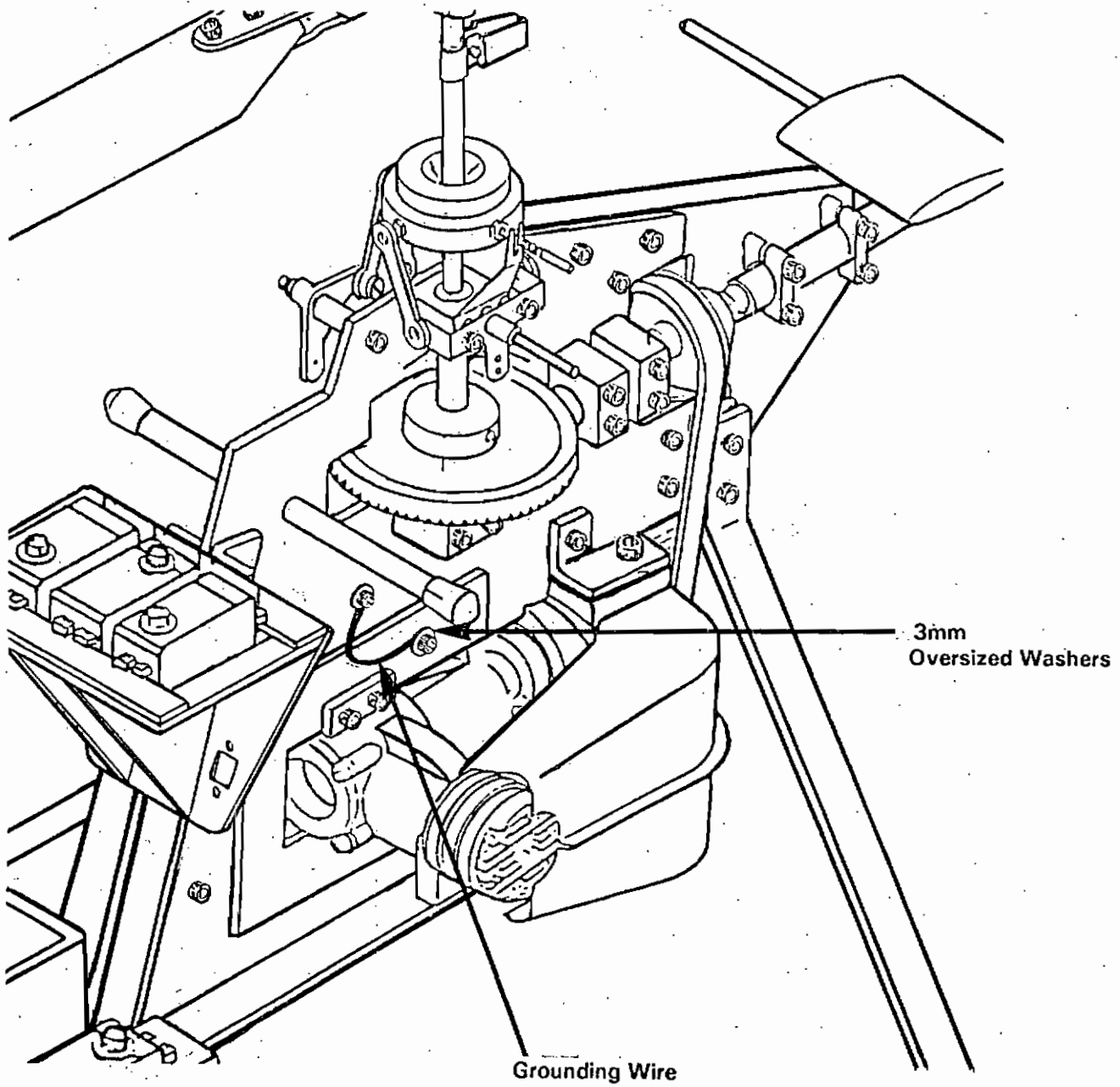


Use two special shim washers included in the bag with the brass main rotor shaft spacers as shown.

HAVING RADIO PROBLEMS WITH YOUR REBEL?

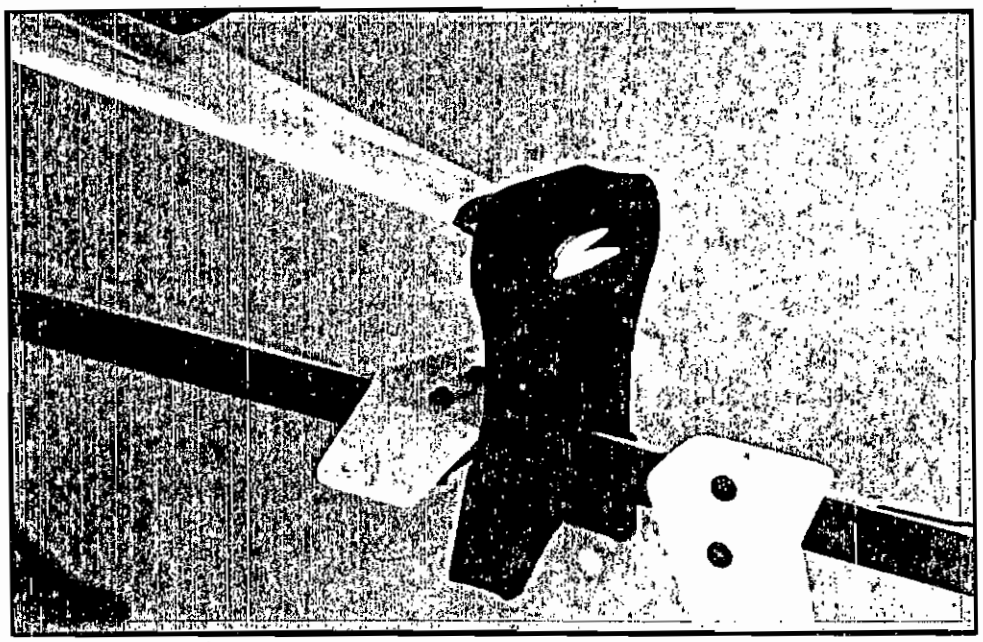
We have heard of a few reports of radio 'glitches' with the Rebel. If you are unfamiliar with this phenomena, a 'glitch' is when one or more of the servos suddenly pulse giving an undesired control input. Obviously, if this condition is severe enough, it could lead to loss of control of your helicopter. It tends to be much more common with helicopters than with airplanes because of all the rotating and vibrating metal parts.

If your Rebel is experiencing glitches, we have found the solution is to 'ground' the motor mount plate to the main 'frame'. To do this, attach a grounding wire as shown in Figure 1. (Multistranded copper wire is good, braided grounding wire is better. See your local radio store for help.) Use 3mm oversized washers underneath the bolt heads to help secure the wire. Also, be sure to scrape off the black anodizing underneath the washers to ensure a good ground.



REBEL STORAGE AND TRANSPORTATION UPDATE

When your Rebel is not flying, it is important to fold the main rotor blades back along the tail boom as illustrated. The rotor head of the Rebel is constructed of nylon which tends to 'cold flow' over long periods of time resulting in a slight droop in the rotor blades. This phenomena has no effect on the strength or flying qualities of the rotor head. You may consider using GMP's Rotor Blade Stand #632 which is an excellent way to secure the blades to the tail boom thereby making the transportation of your helicopter much safer and easier.

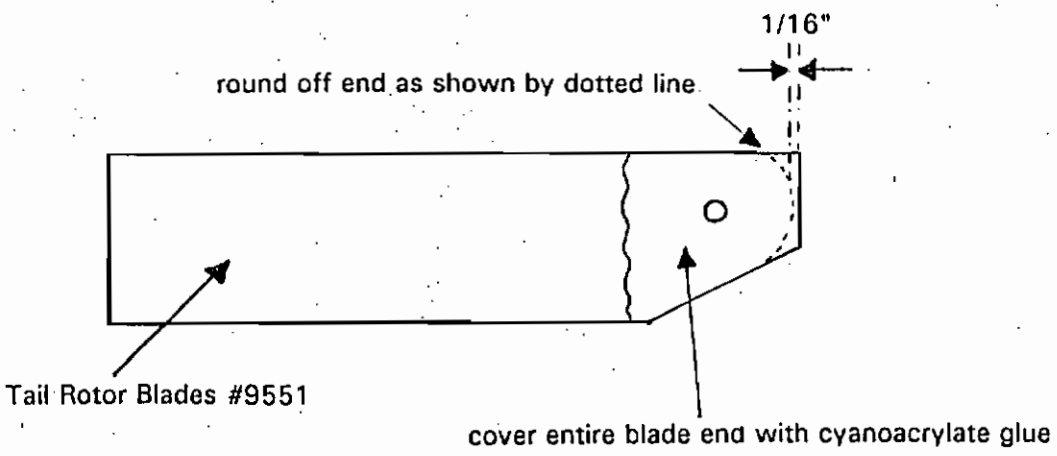


REBEL TAIL ROTOR BLADE UPDATE

ADDENDUM SHEET TO BASIC REBEL ASSEMBLY MANUAL

Page 23: Step 1

The Rebel now comes standard with lighter wood tail rotor blades for improved tail rotor response. Before using these blades, they should be lightly sanded and the end that attaches to the blade holders should be saturated with cyanoacrylate glue for added strength. To finish the blades, round off the end that attaches to the blade holders as shown. Next, use the heat shrink tubing provided #667W and shrink the tubing over the blades. We have found that a heat gun or steam generated by boiling water on a stove works well.



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