LEGEND

"HOW TO FLY" MANUAL

Issue 3

GORHAM MODEL PRODUCTS, INC.,
Calabasas, California USA

FINAL ADJUSTMENTS AND LEARNING TO FLY.

The Legend helicopter is intended for the modeler who has had some experience in building and can (or has) at least hovered an RC helicopter. However, in the event that a 'first timer' has purchased this kit, a set of flying instructions appropriate to his experience is included here. The accomplished flyer will already possess this expertise and he will rapidly explore the capabilities of Legend in aerobatic flight.

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 with about 12% nitro in it 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 should 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 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 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 "Legend" 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 helicopter blade angle setting in pitch (main and tail) 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 cannot 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 Legend 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. So, if there is any doubt about this, stop your engine and check that the gyro cuases the tail blades to move in a direction to oppose the 'yawing' of your helicopter.

FINAL ADJUSTMENTS AND LEARNING TO FLY.

'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 enge 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 Legend should be around 1,700 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 Legend's blade speed is lower than 1,700 RPM, then we should lower 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 the rotor speed of the helicopter.

Because Legend has 'collective' pitch you may also change the rotor speed by increasing or decreasing the collective pitch setting after 'tracking' the blades as described above.

Finally, please 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.

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 to the right, then you are probably running with too little pitch on the main blades at lift-off. You will soon become accustomed to being able to adjust both the speed of the main rotor blades and the tracking of the blades by adjusting one of them.

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 lever, 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 commence 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 3 and 5 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

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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.

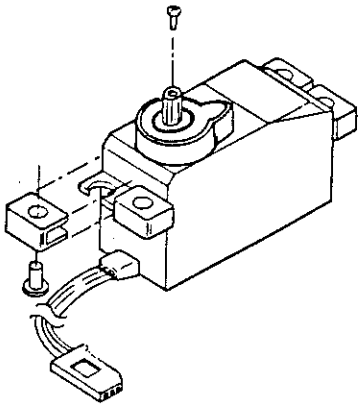
LEGEND

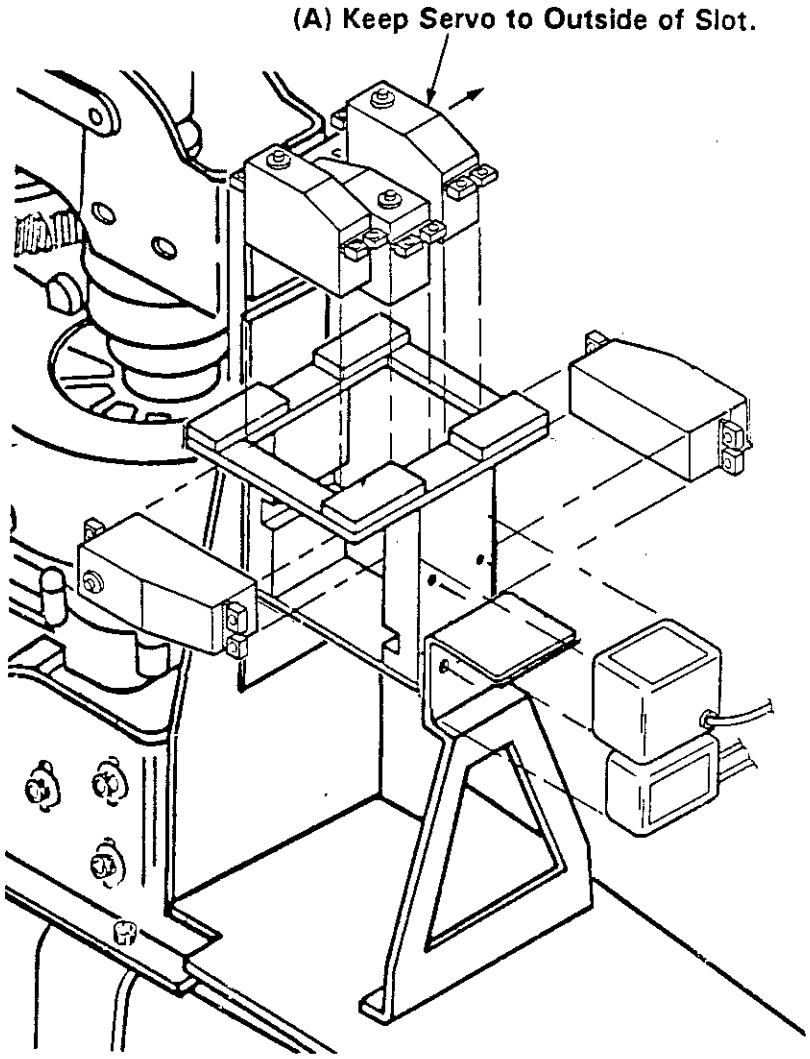
CONTROLS SET-UP MANUAL

Issue 3

GORHAM MODEL PRODUCTS, INC.,
Calabasas, California USA

STAGE 1 CONTROLS - FIT SERVOS





STEP 1 PREPARE SERVOS

Prepare five servos as shown, with the rubber mounts and the brass bushes. RC helicopters need high quality servos so please use at least Futaba 131S or equivalent. The use of a 'cheap' 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 five servos into the servo mount as shown. 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. Helicopter servos need to be more firmly mounted than in airplane use. Check that the tail rotor servo is mounted towards the outer side of the tray slot so that the servo to tail rotor control rod will clear the main frames (see 'A' above).

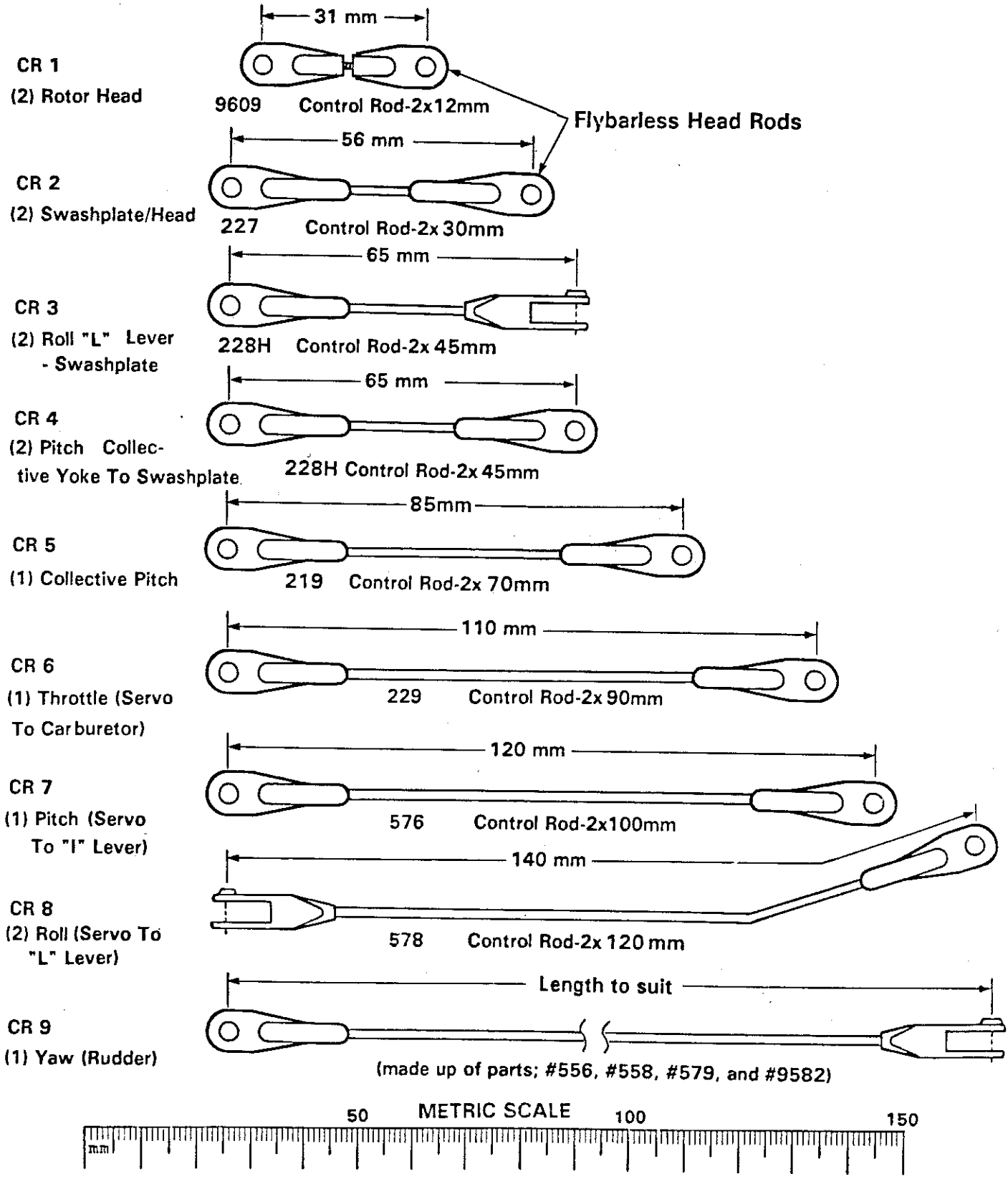
STEP 3 FIT GYRO

When the servos are all fitted you can then fit your gyro and control unit. The gyro should be mounted on 1/16" double sided tape. Some control units will fit in the space shown in the sketch. All the servo arms will be prepared and fitted in the next stage.

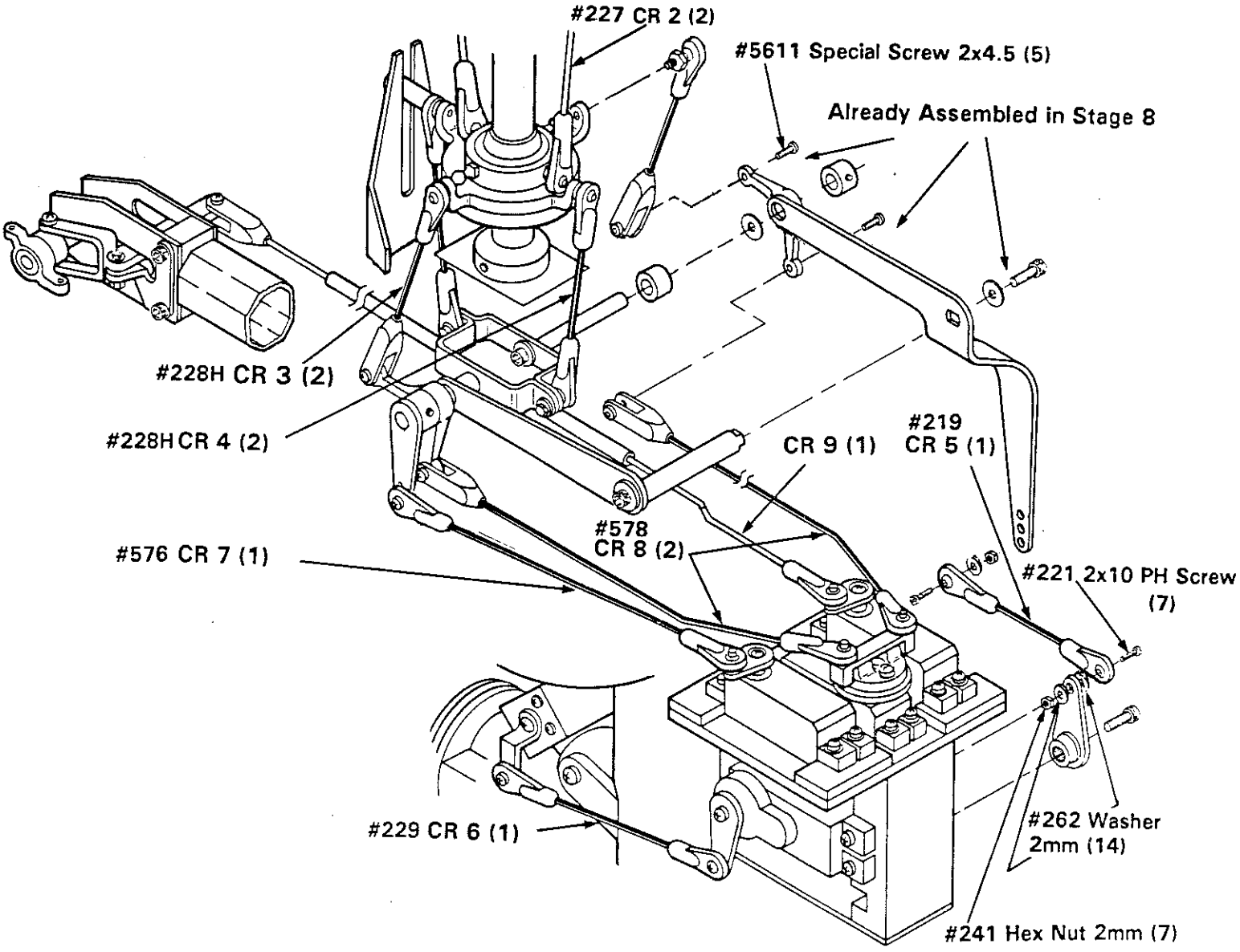
STAGE 2 - CONTROL RODS

STEP 1

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.



STAGE 3 CONTROLS - FIT CONTROL RODS



STEP 1 FIT SERVO ARMS

Fit arms to each servo as shown. Check with Steps 2 through 5 on following pages for lengths and types of servo arms and for the proper angles of each control lever/servo arm. Your radio should be temporarily connected at this stage and the arm centered, with all transmitter controls at center or neutral position. Always be very careful that the balls connected to the arms are firmly and carefully fitted. 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 balls as shown. Where a special bolt is used in a clevis rod end, tighten fully then back-off 1/2 turn.

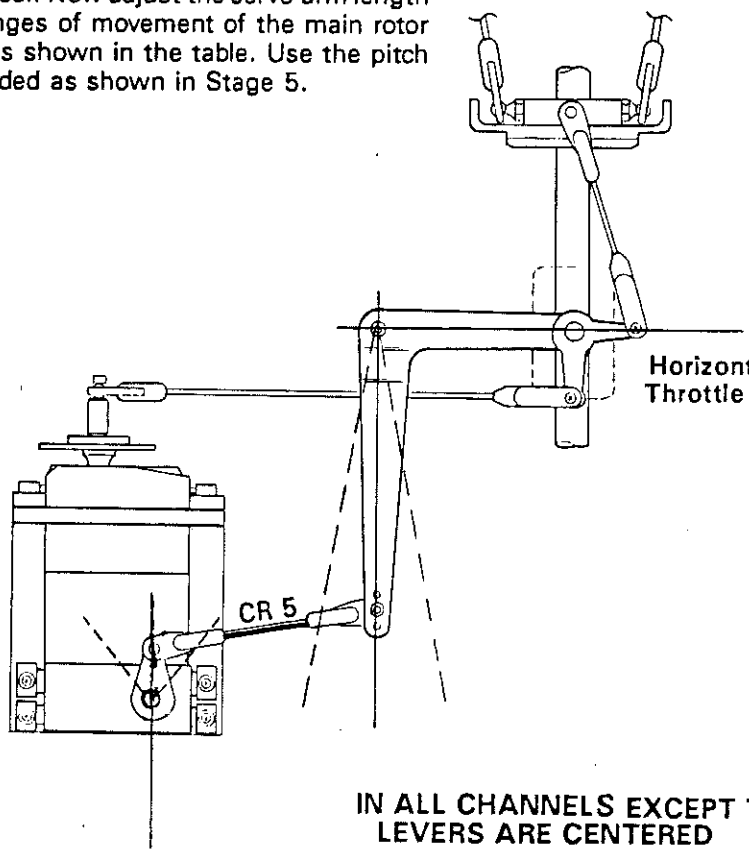
STEP 3 CHECK CONTROLS

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 4 SET-UP CONTROLS

STEP 1 COLLECTIVE PITCH.

Fit the servo arm onto the servo, vertical to the servo body as shown, Adjust rod CR5 length until the long arm of the 'L' shaped collective lever is vertical. Now adjust the servo arm length until the ranges of movement of the main rotor blades are as shown in the table. Use the pitch gauge provided as shown in Stage 5.



IN ALL CHANNELS EXCEPT THROTTLE, TRIM LEVERS ARE CENTERED

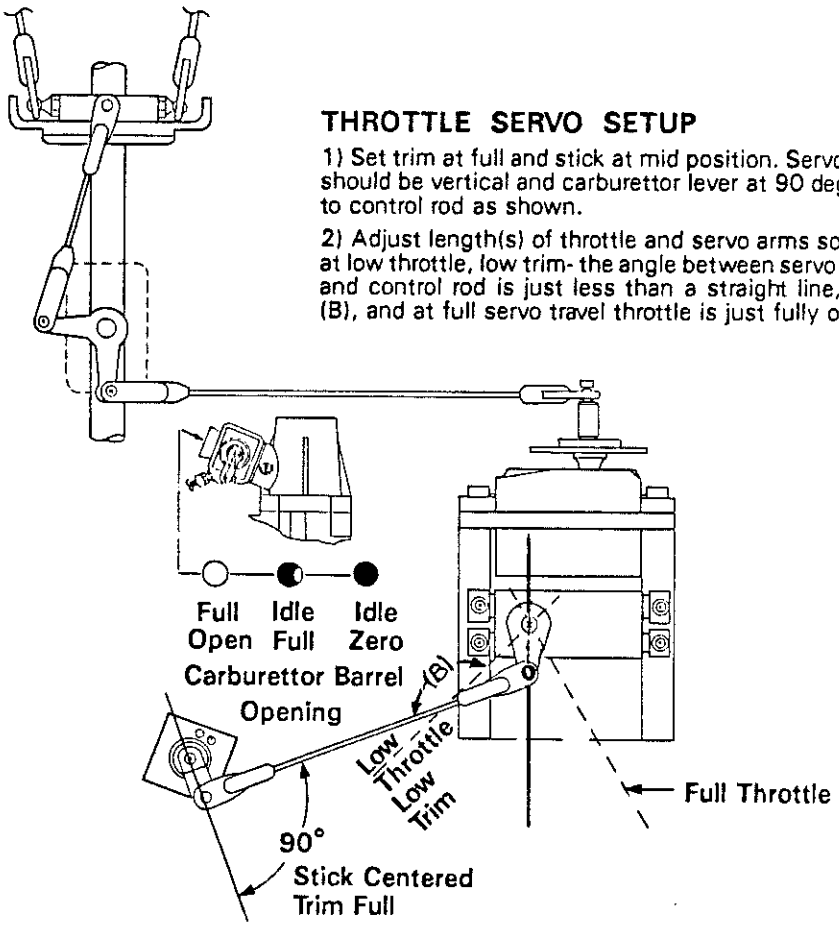
ALL CONTROL RANGES ARE MEASURED AS MAIN ROTOR BLADE ANGLES

ADJUST SERVO ARM LENGTHS TO PRODUCE THE FOLLOWING ROTOR BLADE ANGLES:

FUNCTION		ROTOR BLADE ANGLE	TRANSMITTER STICK POSITION
COLLECTIVE PITCH	−	1 1/2 to -3 Degrees	Low End
	+	3 1/2 to +4 1/2 Degrees	Stick Centered
	+	8 to +10 Degrees	High End
ROLL	±	4 to 4 1/2 Degrees	Low Rate
	±	5 1/2 to 6 Degrees	High Rate
CYCLIC PITCH	±	4 to 4 1/2 Degrees	Low Rate
	±	5 1/2 to 6 Degrees	High Rate
TAIL ROTOR		Full Travel of slot in tail unit side plate.	High Rate

STAGE 4 SET-UP CONTROLS

STEP 2 THROTTLE



THROTTLE SERVO SETUP

1) Set trim at full and stick at mid position. Servo arm should be vertical and carburettor lever at 90 degrees to control rod as shown.

2) Adjust length(s) of throttle and servo arms so that at low throttle, low trim- the angle between servo lever and control rod is just less than a straight line, See (B), and at full servo travel throttle is just fully open.

STEP 3 ROLL

ROLL SERVO SETUP

1) Fit the rocker unit to the roll servo as shown (use a medium size wheel output part provided with your radio)

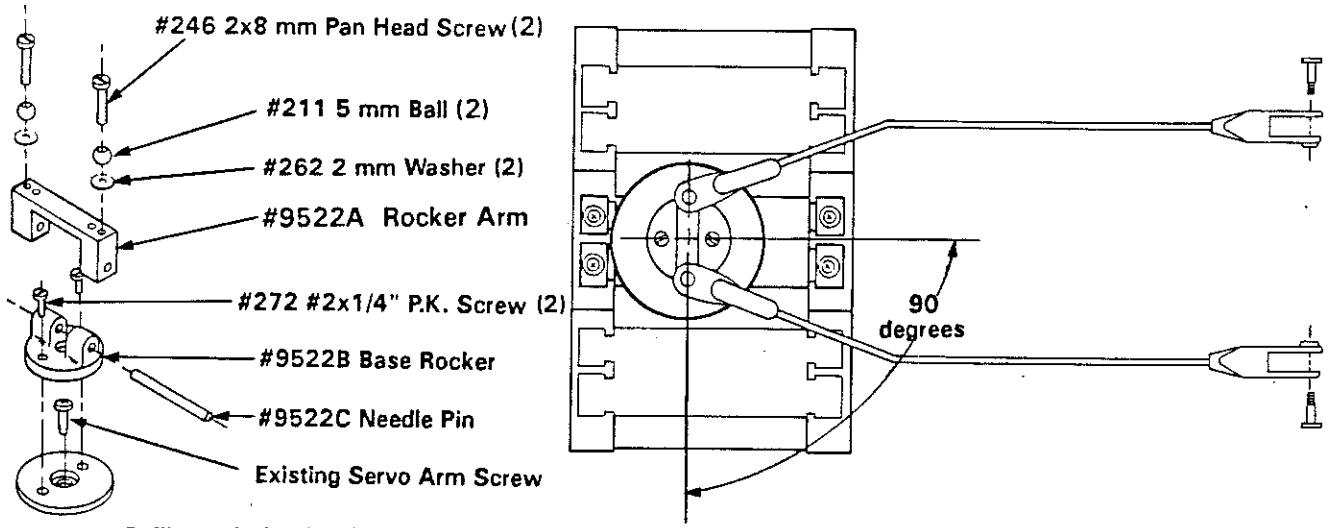
2) Fit the two 5mm balls to the rocker arm outer holes as shown. Use cyanoacrylate glue to cement the 2x8mm pan head screws firmly into the plastic.

3) Fit the rocker unit onto the servo so that it is in the position shown with the transmitter roll lever centered. You will need to drill two 1/16" (1.5mm) holes in the servo output wheel for the two #272 self tapping screws which hold the rocker unit onto the wheel.

4) Check that you have the main rotor blades angle movements shown in Stage 4 page 4. and, if you have dual rates on your transmitter adjust the low rate setting to produce the lower values of the main rotor blade angles shown.

Roll Rocker Unit

Note: Holes in servo wheel must be located so that the rocker unit will be at 90 degrees (as shown) when transmitter roll lever and trim lever are centered.



Drill two holes (#52 1/16" drill) in servo wheel and mount rocker unit securely with two #2x1/4" P.K. screws, #272.

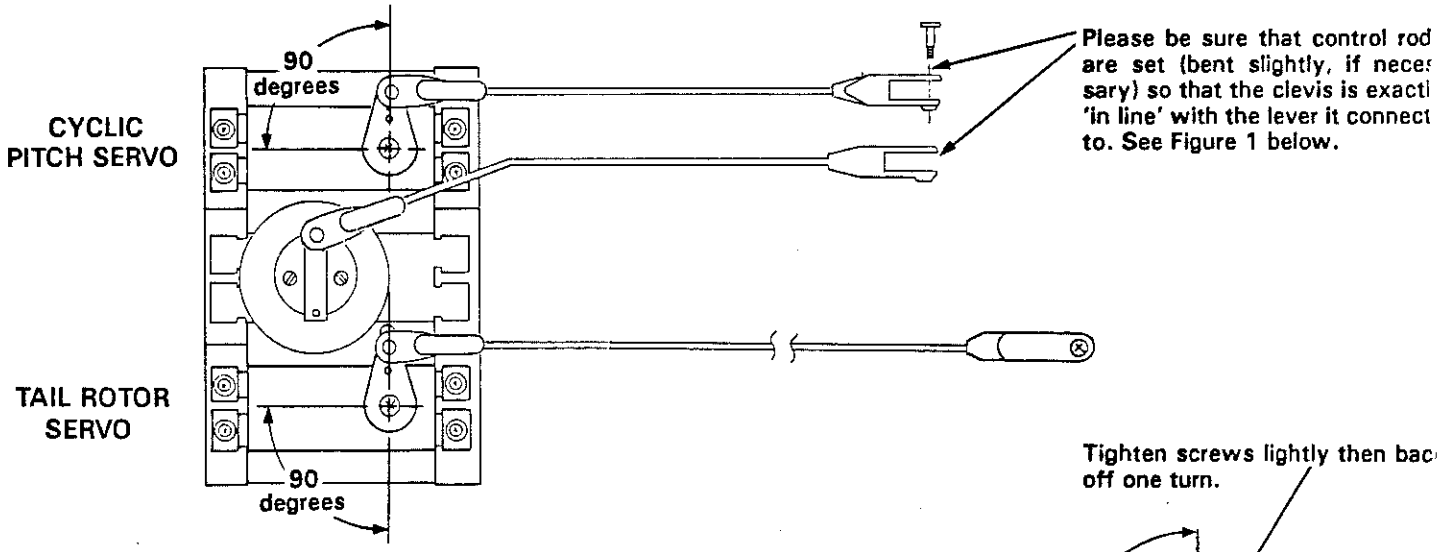
STAGE 4 SET-UP CONTROLS

STEP 4 CYCLIC PITCH CONTROL

1) Set the servo arm as shown with transmitter pitch lever at neutral and trim centered. The pitch lever on collective shaft should be vertical and the swashplate level.

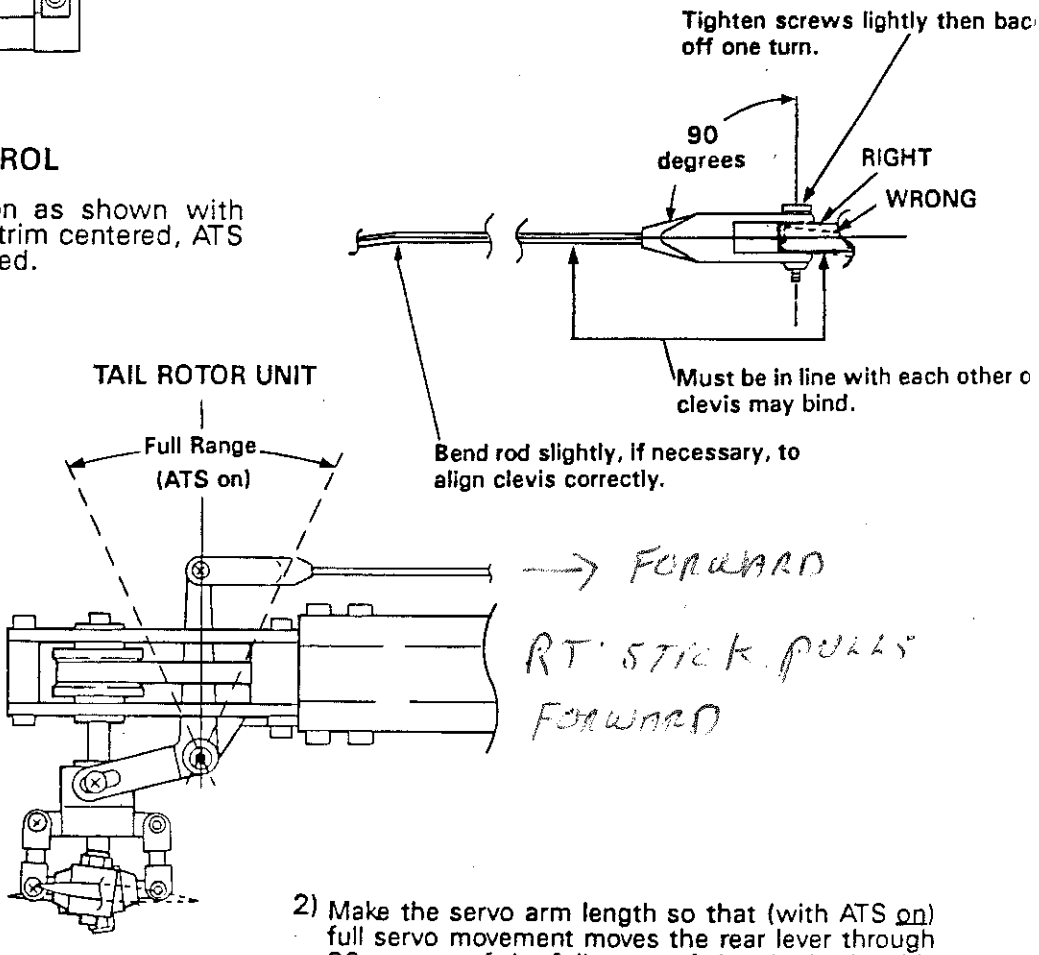
2) Adjust the servo arm length so that the main rotor blade angles shown in Stage 4,Page 4 are obtained.

3) If you have a dual rate function on your transmitter set the low rate movements as called for in Stage 4, Page 4.



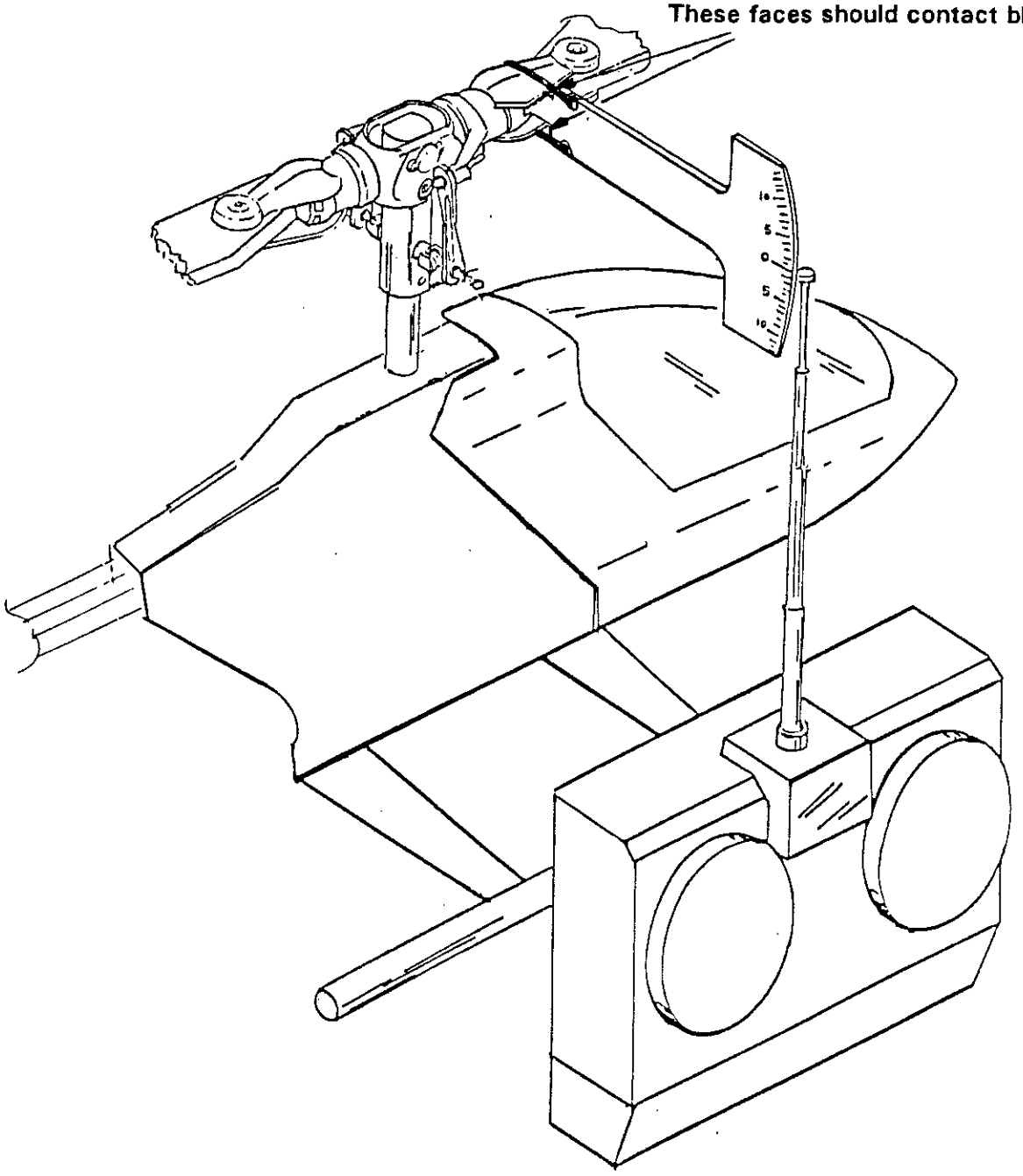
Step 5 TAIL ROTOR CONTROL

1) Set the servo arm position as shown with transmitter lever centered, trim centered, ATS on and throttle lever centered.



2) Make the servo arm length so that (with ATS on) full servo movement moves the rear lever through 90 percent of the full range of the slot in the side plate (a little must be left at each end for full trim range).

STAGE 5 CONTROLS - FINAL CHECK
MAIN ROTOR BLADE PITCH ANGLE MEASUREMENT



MAIN ROTOR BLADE PITCH ANGLE MEASUREMENT

The pitch gauge provided with your Legend can be used to very accurately measure the main rotor blade angles for cyclic and collective i nputs. Because it is such a simple procedure with a flybarless head, you can make a direct measurement anytime you change a setting in your transmitter, or even observe the changes in pitch as you make adjustments on your transmitter controls. You will soon get used to really knowing the actual blade angles and ranges you are flying, which will be a great advantage in resetting due to servo changes or after a rebuild. In our sketch we have shown the transmitter antenna being used as a pointer - this is very convenient on the field. Of course, you can set the measurement point in many other ways. To set "0", just sight down the blade and line up your blades so that the top of the pitch gauge is horizontal, or at 90 degrees, to the main shaft. Extreme accuracy here is not too important since it is the angular ranges and changes in angles which we are mainly concerned with.

LEGEND

BASIC ASSEMBLY MANUAL

Issue 3

GORHAM MODEL PRODUCTS, INC.,
Calabasas, California USA

INTRODUCTION

Legend is a most extraordinary new 50/60 powered RC sports/contest helicopter by GMP which has been added to its ever increasing range of RC helicopters. The special features are lightweight, mainly metal construction and versatility. Legend can be flown in many different configurations to suit all pilots and moods.

INNOVATIVE CONSTRUCTION

This new helicopter has been carefully designed with an optimum mix of injection molded parts and the return of two new space-age materials - aluminum and steel! Main frames and many other metal parts are fabricated in California from 80 thousandth of an inch thick (2mm) special alloy anodized aluminum. This alloy is more ductile than 6061 T-6 so all of the essential frame bends are made with less chance of stress. It also does not work harden as 6061 T-6 does.

ADVANCED ROTOR DRIVE SYSTEM

Legend uses the now famous Cobra/Competitor drive train with its one piece clutch and clutch bell design. Pioneered by GMP it is now adopted as standard by many other helicopters. The tail drive uses a toothed belt to the tail rotor unit which is made of precision quality aluminum alloy and steel. The tail rotor drive on your Legend is interchangeable between belt and gearbox - your choice - since the main frames are drilled for either.

PREASSEMBLED PARTS

The main rotor head and tail blade hub unit come fully assembled, as does the servo tray unit. There are no plywood parts to cut out or assemble.

Legend employs many special parts pioneered by Hirobo such as their coaxial swashplate and autorotation unit. Most of Legend's other parts are designed and manufactured in the USA.

NEW FLYBARLESS ROTOR HEAD

A special new Legend feature is the Delta 3 stabilized, flybarless rotor head. GMP has been experimenting for many years, striving to produce a simple "Bell" only rotor head with all the stability and aerobatic capabilities of the currently popular "Bell-Hiller" mix flybar head but without its complexity and aerodynamic drag. Success was achieved and the result is Legend's new rotor head. It is simple - all-metal, yet very light. It is highly aerobatic, yet stable. The Delta 3 flybarless head now opens up a whole new class of fast, aerobatic flying - very suitable for the "hot dogger".

This new GMP rotor head has two simple control rods activating the main rotor blades and eliminates the seesaw, stabilizer paddles, flybar control arms, washout and mixing arms. Your Legend flies with less drag, less weight, easier set-up and dynamic trouble-free performance. However, for those who prefer a rotor head using a "Hiller" stabilized flybar system, Legend will accept and give superlative flight performance with the GMP Custom and Pro rotor heads. Other new heads are in process.

TECHNICAL FEATURES

LEGEND statistics (Delta 3 flybarless head version)

Power 7.5-10cc	45-61 cu in.
Main Rotor Span	55" (140 cms)
Tail Rotor Span	10" (25.4 cms)
Engine to Main Rotor ratio (9.5 to 1 optional)	8.6 to 1
Main Rotor Speed (recommended)	1750 rpm
Tail Rotor to Main Rotor ratio (belt drive)	4.75 to 1
Height	18" (45.75 cms)
Length (excluding Main Rotor blades)	50" (127 cms)
Weight (dry) (with gyro, 1000 ma pack, 61 engine & muffler)	8.8 lbs (3.85 kgs)
Radio Installation	5 servos
Gyro	Recommended

TRIPLE BEARING MAIN AND TAIL ROTOR HEADS

Legend's unique thrust bearings are on the main shaft, tail rotor and rotor head.

The very high centrifugal forces that exist on the bearings of both main and tail blades of RC helicopters have in the past been taken on one 'standard' ball bearing. The 'standard' ball bearing is designed primarily for radial loads and is not optimum for use where high 'end' or 'pulling' forces are incurred. The Legend main rotor blades utilize a triple bearing system with a heavy duty thrust bearing fitted into each blade holder, together with two fine quality ball bearings to take the radial loads just like the full sized choppers. In addition, the end-play can be adjusted at any time to provide a minimum of 'back-lash' utilizing a double locking system. This insures fast and low friction main rotor blade rotation during flight without any lost motion. Again a prerequisite to accurate and advanced aerobatic flight. The tail rotor blade holders are fitted with the same triple bearing system - another industry first. The main shaft is also fitted with a thrust bearing so that your whole helicopter lifts its weight on the finest bearing arrangement possible.

MAIN ROTOR BLADES AND AUTOROTATION

The main rotor blades of the Legend have an advanced and modern semi-symetrical section and are fully completed with blade grips and slots for C.G. correction weights. They are carefully

matched in weight to your new flybarless head and Legend's physical characteristics. The C.G. corrected heavier blades, the main shaft thrust race, plus the lower drag of the flybarless head, all contribute to Legend's superior autorotation ability. In fact, many flyers have reported the ease with which the Legend can be landed after an engine failure compared with other RC helicopters.

The GMP Legend autorotation gear is fitted with three precision roller bearings, rather than the single one used in some RC helicopters. Consequently, the life and reliability of this unit is very much higher than others with single bearings.

The main plastic drive gear itself is of a very sturdy construction and, for a Legend which uses a tail gearbox system, the tail drive gear track provides a very wide contact area because the tail drive system uses advanced design spiral hypoid bevel gears. This means less likelihood of damage to the main drive gear track. Should the main gear be damaged, however, a replacement part is readily available at a very low cost. In the case of the tail belt drive version of Legend, a precision steel spur gear, running in dual ball bearings, mates with the side teeth of the main gear.

STARTING SYSTEM

The standard starting system of the Legend is the top cone start now demanded by discriminating modelers world wide. This greatly eases the starting process and eliminates any problems which can arise when starting with a starting belt.

CLUTCH DESIGN

The clutch is a classic one-piece design machined from steel, not plastic, and it provides superior and reliable performance. This 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 machined for your particular kit to provide correct engagement and reliable operating performance.

ENGINE INSTALLATION

The engine of the Legend faces to the rear to permit quick glow plug changes. It is also mounted in the frames in such a way that it can be dropped out through the bottom of the helicopter. The headaches sometimes associated with 'engine change' or removal for servicing are virtually eliminated with the GMP Legend.

QUALITY HARDWARE

The Legend 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, the bolt provides more tensile strength for a given diameter. 90% of the world's RC helicopters now use metric hardware. The GMP Legend's metric system is a world standard one and is interchangeable with the GMP Cricket, Competitor, Cobra and nearly all Japanese and European RC helicopters.

LOW AERODYNAMIC DRAG

The canopy of the Legend has been designed to give very low aerodynamic drag because of its shape and very small frontal profile. Field removal and replacement of Legend's canopy is very easy and quick thanks to its new and unique "slide-loc" attachment design.

BUILDING

Building Procedures

The Legend 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.

Any mistakes in setting-up the controls of a high performance helicopter like Legend will show up much more in flight characteristics and reliability than with the simpler helicopters such as Cricket, etc. 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. The tools that you will need include:

- o pair of scissors.
- o small screwdrivers (flat and phillips)
- o allen keys (provided in the kit)
- o 7/32" or 3mm nut driver (which can be pur chased from your radio parts store)
- o pair of pliers
- o modelling knife
- o 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. Blue 'Loctite' is provided in your kit.

The construction of Legend does not require any machine filing or sanding and so does not necessitate a work bench. However, do be sure to cover your work surface with thick paper or cloth material since the metal parts of Legend can scratch polished table surfaces.

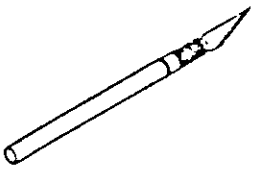
One important factor in building an RC helicopter, which cannot be stressed enough, is that all nuts (other than 'lock' nuts) and threaded devices should be assembled using blue 'Loctite' or equivalent, so as to make separation of these components by vibration improbable. It is also important to note 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 the 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.

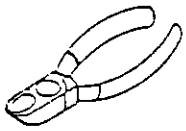
Don't forget to build under a good light. Build slowly and please, please, read all the instructions very carefully. They have been written with a lot of care to try and cover every point. Even so, your comments on how we can improve our instructions are always welcome. We will continue to upgrade and try to make the "Legend" 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

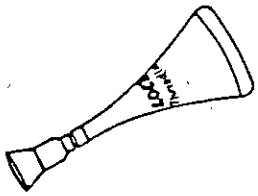
"Exacto" Knife



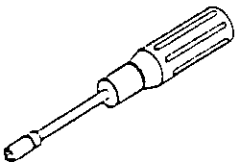
Side Cutting Pliers



Blue Loctite (Provided In Kit)

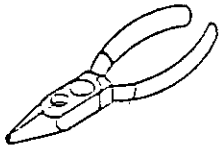


Nut Driver For 3 mm Nut

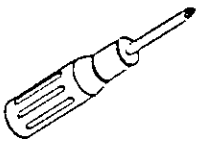


Scissors

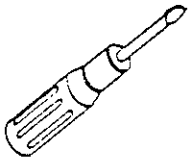
Needle Nose Pliers



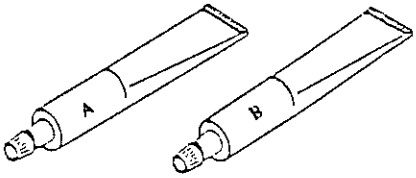
Small Phillips Screw Driver



Small Standard Screw Driver

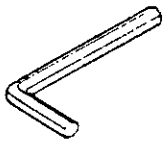


30 Minute Epoxy



Cyanoacrylate Glue (10 Second)

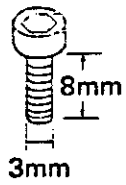
Allen Wrenches 1.5, 2.0, 2.5, 3.0 mm
(Provided In Kit)



AVAILABLE AT YOUR HOBBY STORE

TYPES AND SIZES OF HARDWARE ITEMS

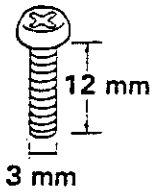
SOCKET HEAD SCREW



Example: 3x8 mm SH

- Dia. Of Screw: 3 mm
- Socket Head
- Length Of Screw: 8 mm

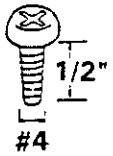
PAN HEAD MACHINE SCREW



Example: 3x12 mm PH

- Dia. Of Screw: 3 mm
- Pan Head
- Length Of Screw: 12 mm

TAPPING SCREW (P.K.)

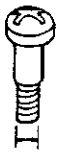


Example: #4x1/2" P.K.

- Dia. Of Screw: #4
- Tapping screw
- Length Of Screw: 1/2"

(Two Types Are Available)

SHOULDERED SCREW

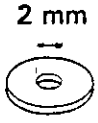


Example: 2.5 mm Special Screw

NUT

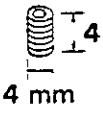
Example: 2 mm Nut

WASHER



Example: 2 mm Washer

SET SCREW



Example: 4x4 mm SS

LOCKNUT

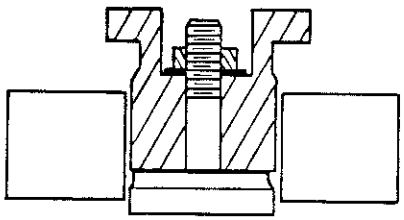
3 mm

Example: 3 mm Lock Nut

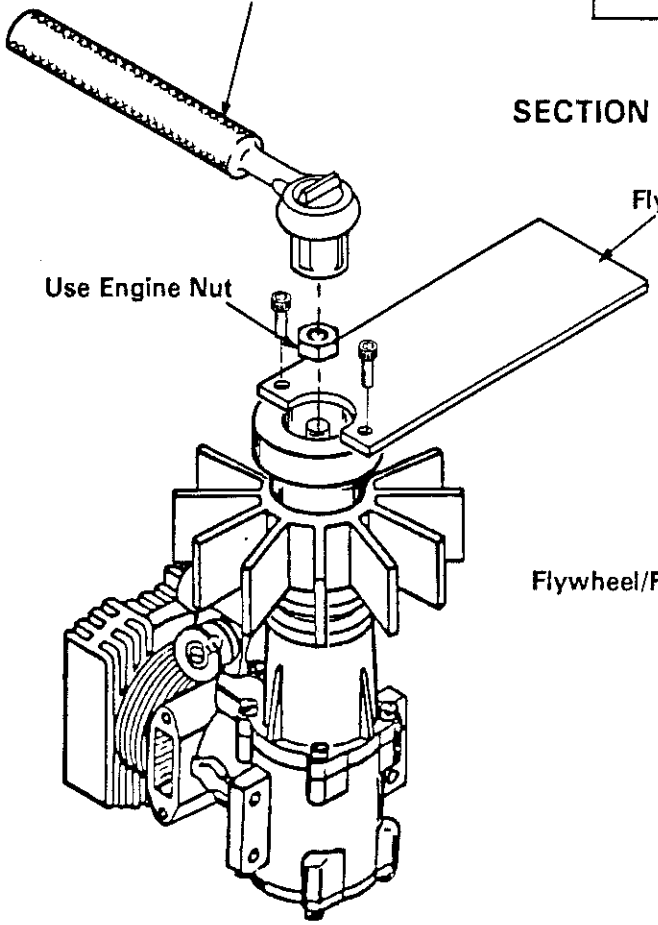
This is a nut with a nylon insert to resist loosening due to vibration.

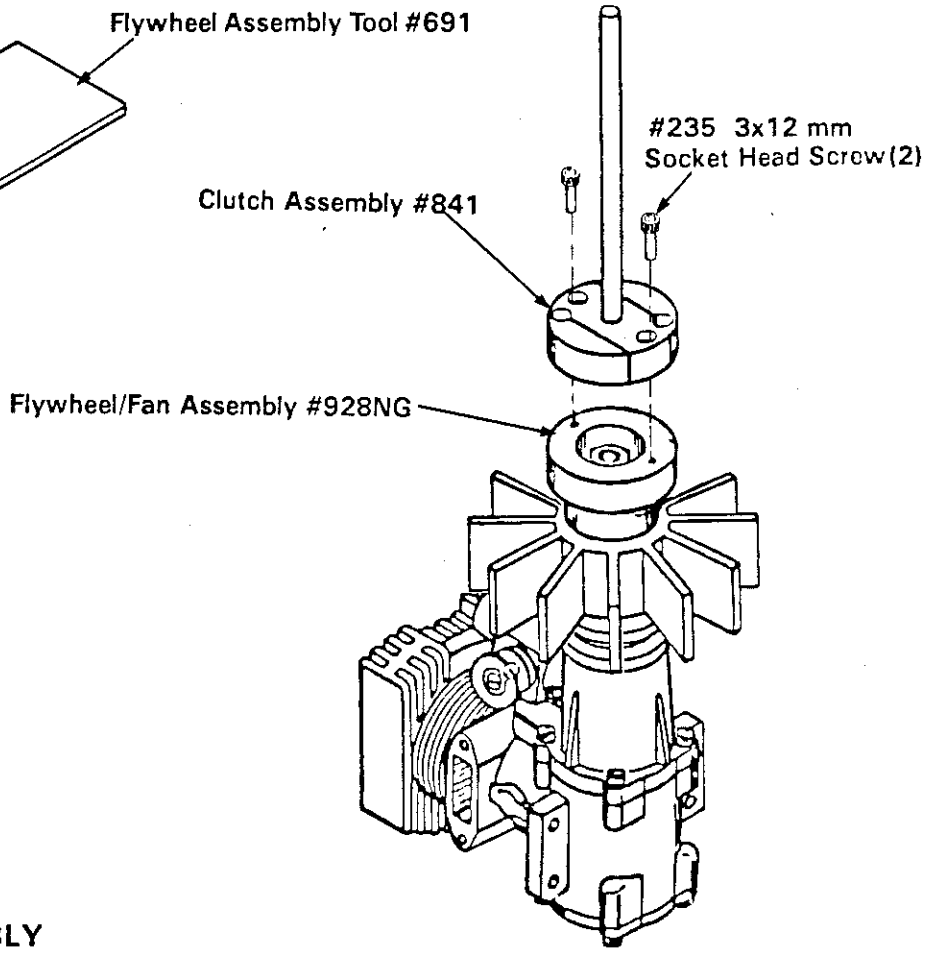
METRIC SCALE

STAGE 1 ENGINE DRIVE UNIT ASSEMBLY



SECTION ENGINE SHAFT/FLYWHEEL





STEP 1 FIT FLYWHEEL ASSEMBLY

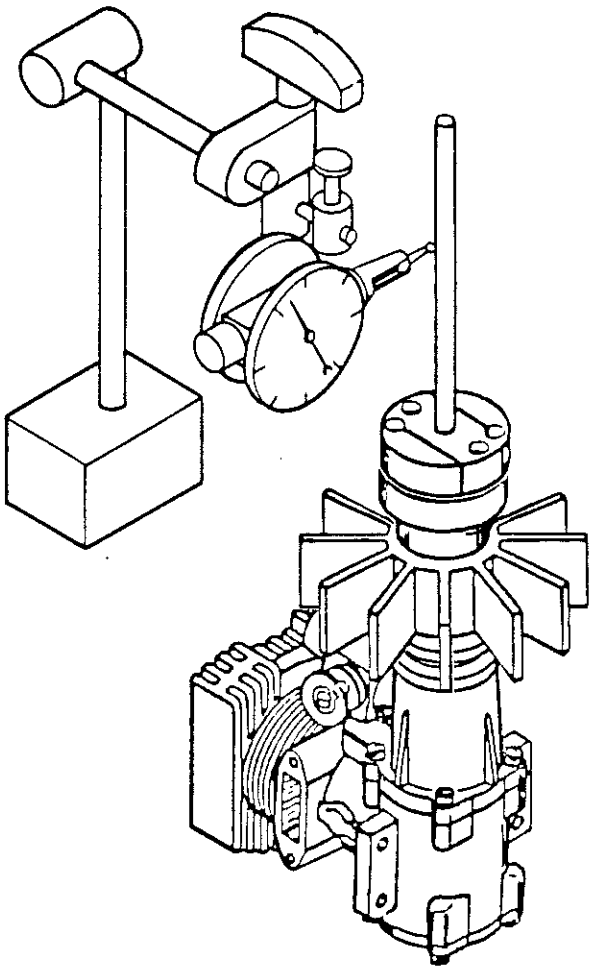
Remove engine nut but not the prop backplate. Drop the flywheel assembly onto the engine shaft. Fit the engine nut onto the shaft. Do not tighten yet.

Fit the Flywheel Assembly Tool #691 onto the flywheel using two 3x12mm socket head screws #235. Tighten the screws (do not use loctite). Holding the tool in one hand and a socket wrench in the other, torque the engine nut very firmly (to avoid loosening if the engine backfires). Remove the tool and set aside.

STEP 2 FIT CLUTCH ASSEMBLY

Fit the Clutch Assembly #841 onto the flywheel using the two 3x12mm socket head screws #235 that were used temporarily in Step 1 putting blue loctite on the threads. Tighten firmly, using the 3mm allen key provided in the kit.

STAGE 1
ENGINE DRIVE UNIT ASSEMBLY (Cont'd)

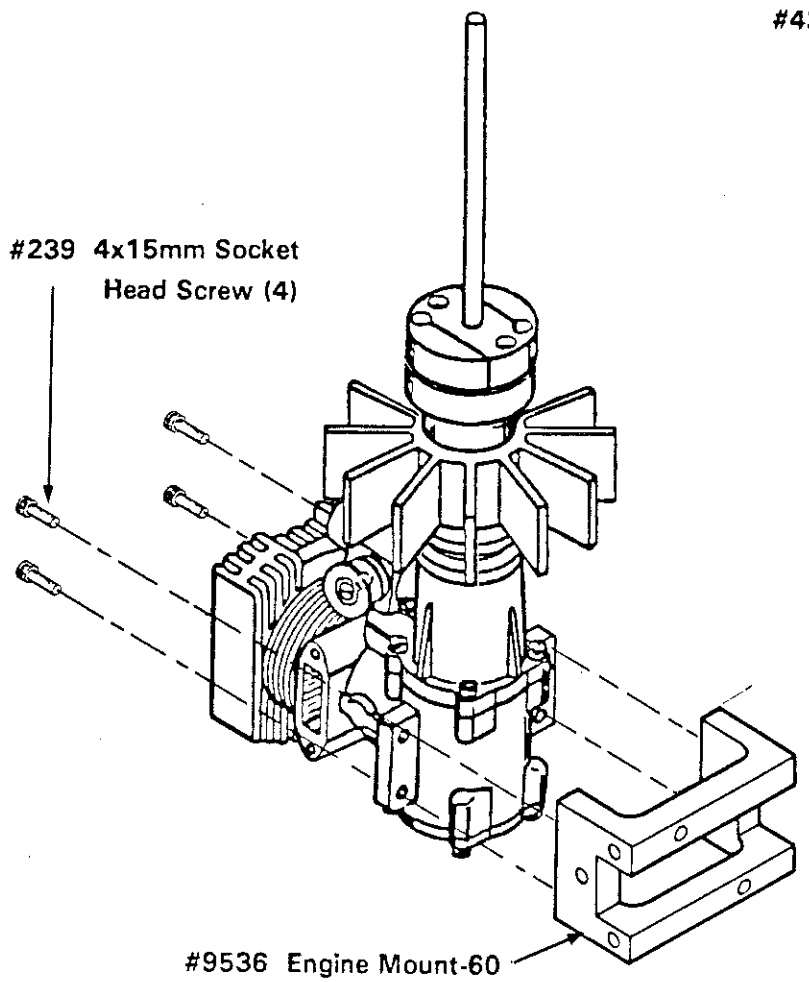


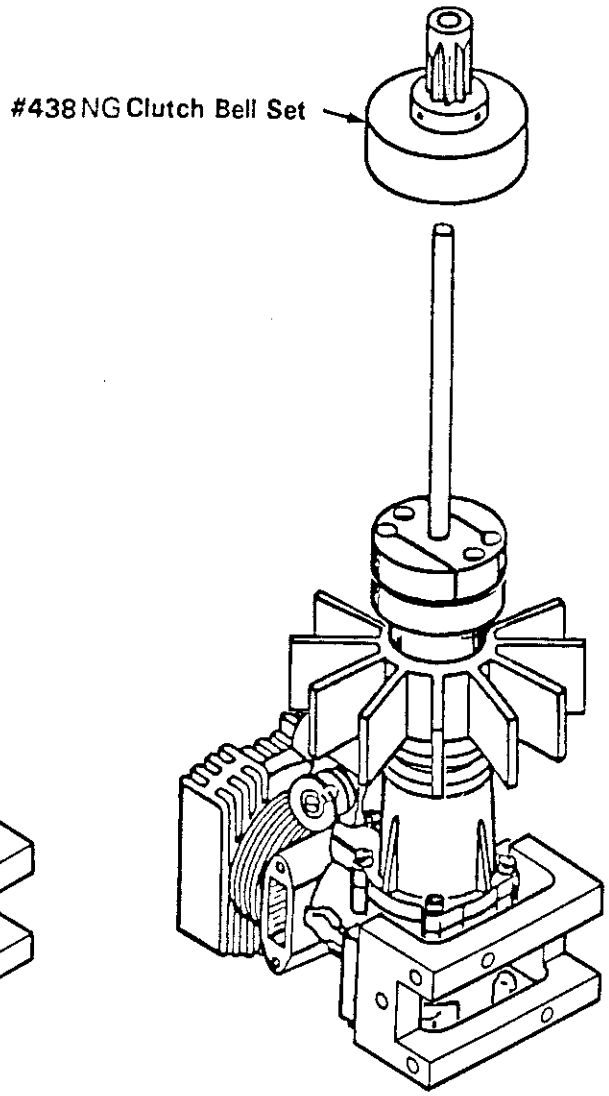
STEP 3 CLUTCH SHAFT ALIGNMENT

The best method for checking the alignment of your clutch shaft is to use a dial gauge indicator, measuring in thousands of an inch or 100ths of a millimeter (1/100mm = 0.4 thous.). It is possible to do this alignment using a wire fastened in a vise and just touching the clutch shaft but you will achieve less accuracy that way. If you use this method, remember that a piece of thin note paper is about 3 to 4 thousands of an inch thick. Now to the method. Fix the engine firmly to the bench with clamps or hold in a vise. Set the dial indicator against the lower end of the clutch shaft with a positive indicator reading. Rotate the engine (glow plug should be out) and measure your run-out. If more than 2 to 3 thousands of an inch (5 to 7 hundreds of a mm), loosen the two 3mm clutch assembly retaining screws and reset the position of the clutch assembly. Retighten the screws. You may also try rotating the clutch assembly 180 degrees. Now thoroughly tighten the two 3mm screws (use blue loctite, of course) and check your run-out again. Repeat the whole procedure if necessary. Finally, check the run-out at the top of the shaft. This run-out may be corrected by using a metal tube over the top of the shaft to gently "tweak" the shaft to the required position.

Note: It is very important that your clutch shaft is running "true" within a tolerance of less than 3 thousands of an inch. The truer the better. So Step 3 is very important and should not be omitted.

STAGE 1
ENGINE DRIVE UNIT ASSEMBLY (Cont'd)





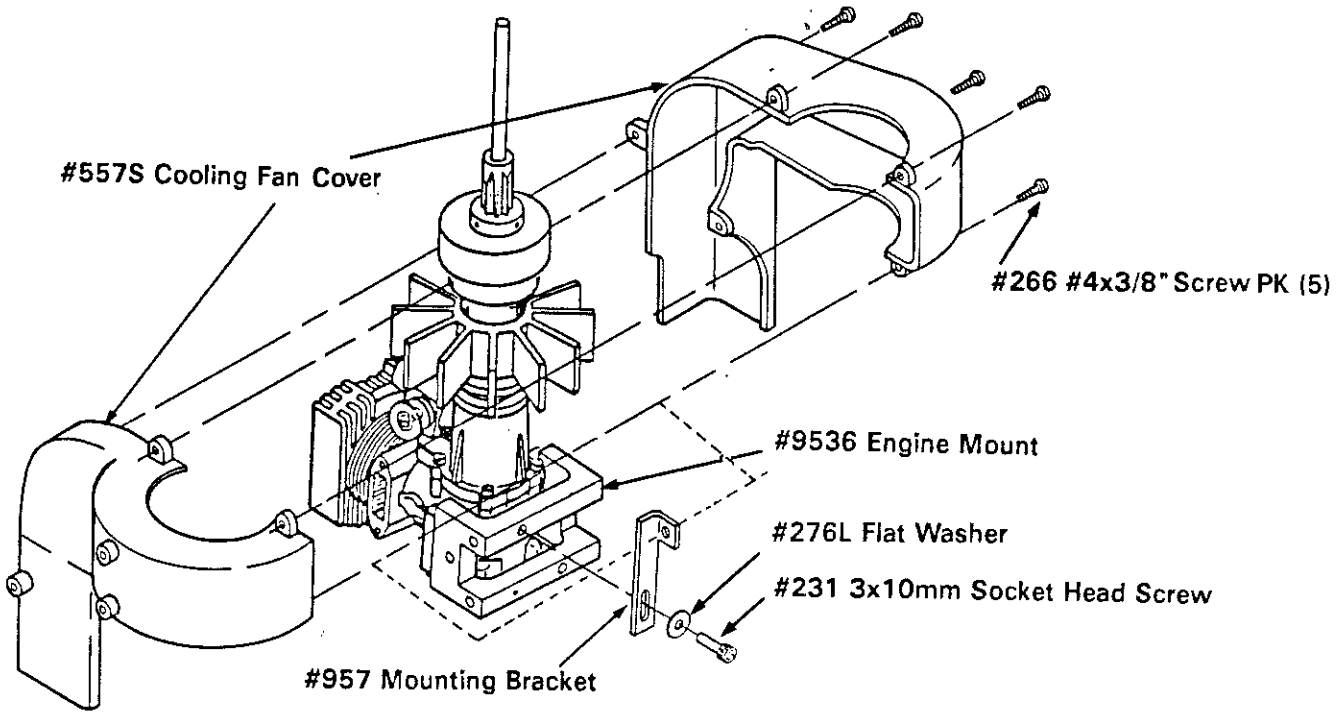
STEP 4 ASSEMBLY OF MOTOR MOUNT

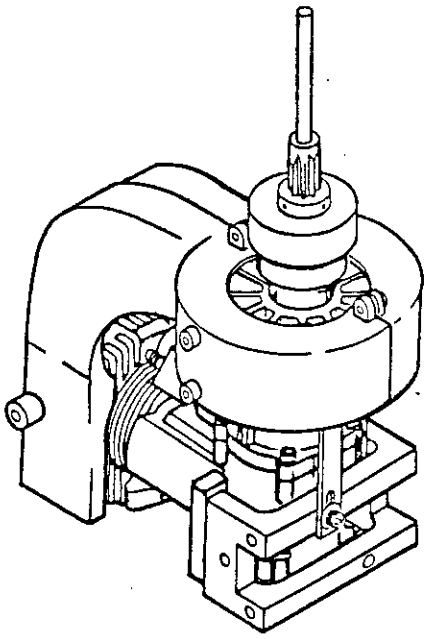
Assemble engine mount to engine, using four #239 4x15 mm socket head screws. Screw fully in but do not finally tighten at this stage. Note that the engine mount can be fitted either way up. One way will result in the engine being higher up in the frames, the other way it will be lower. This is to accomodate engines with different lengths between the engine nut and mounting holes.

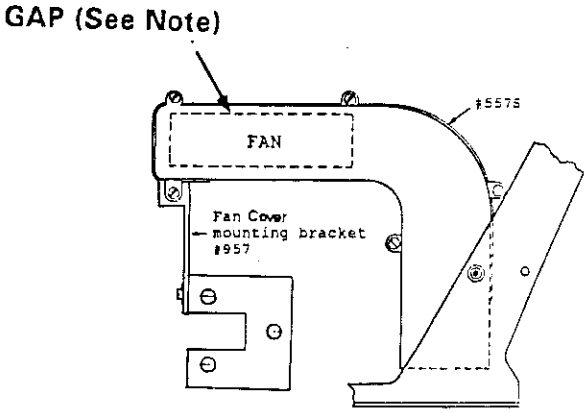
STEP 5 ASSEMBLY OF CLUTCH BELL SET

The clutch bell unit is fully assembled, and the lining has been correctly machined, for you. Just drop the clutch bell assembly fully home onto the clutch. Check that it spins freely.

STAGE 2 COOLING FAN COVER ASSEMBLY







VIEW A

STEP 1 ASSEMBLY OF FAN COVER

First, do a trial assembly onto your engine and be sure that no parts of the engine interfere with the correct positioning of the cover, as shown in View A (see Note). If any engine part fouls the cover, trim the cover as necessary before assembly. Now make the final assembly of the cover using four #4x3/8" PK Screws #266. Secure the cover to the mounting bracket #957 using the fifth #4x3/8" PK Screw as shown . Use one 3x10mm socket head screw #231 and one #276L flat washer to secure the lower end of the mounting bracket to the engine mount (use Loctite). Check that the clearance gap of 1/32" (0.8mm) (see View A) is set properly and then tighten the screw. Put the engine unit aside for final assembly into the main frames.

Note: For the trial assembly described in Step 1 and the final assembly, the gap between the top surface of the cooling fan and the under surface of the fan housing should be as close as possible without touching. About 1/32" is correct. This will ensure the best cooling efficiency.

STAGE 3 LANDING GEAR UNIT ASSEMBLY

STEP 1 ASSEMBLE SKID CLAMPS

Fit and position the landing skid clamps onto the struts, 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 1

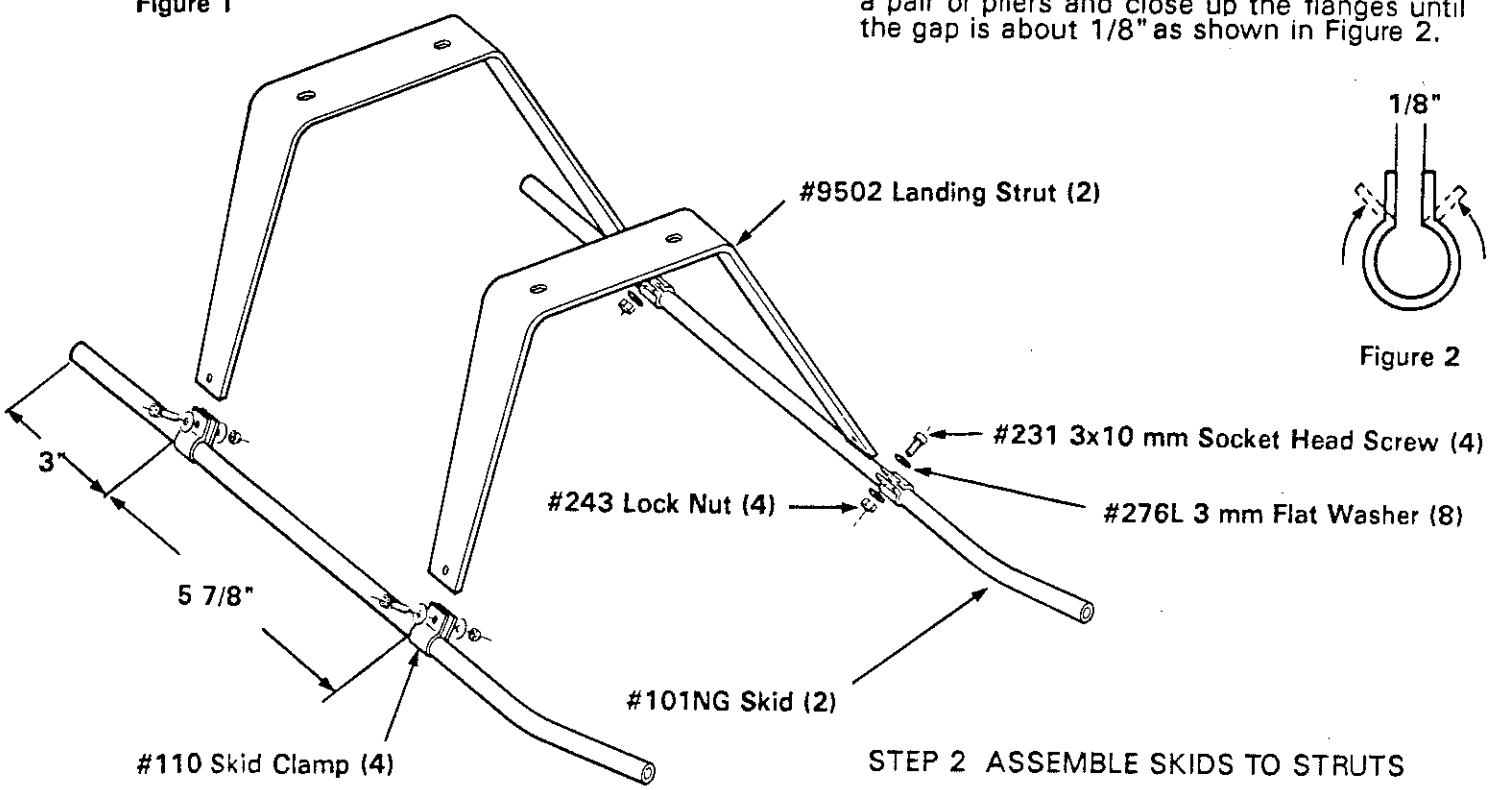


Figure 2

STEP 2 ASSEMBLE SKIDS TO STRUTS

Assemble the two struts using the screws, washers and nuts, as shown. Before final tightening,recheck that the location of all clamps are as shown in Figure 1 Tighten nuts well.

Note: - To avoid loosening of the clamps after many flights, some builders further secure all the skid clamps with a sheet metal screw. Drill 1/16" holes and use #2x1/4" sheet metal screw. A little red locktite or cyanoacrylate glue helps to make the additions more permanent.

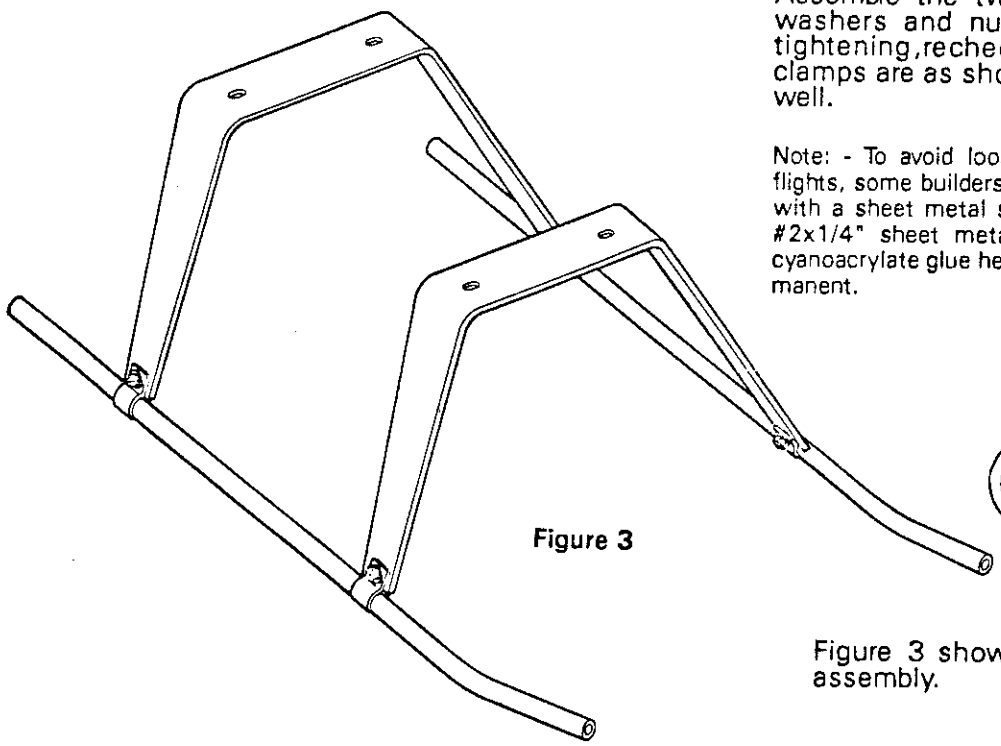


Figure 3

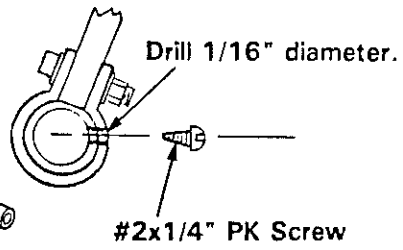
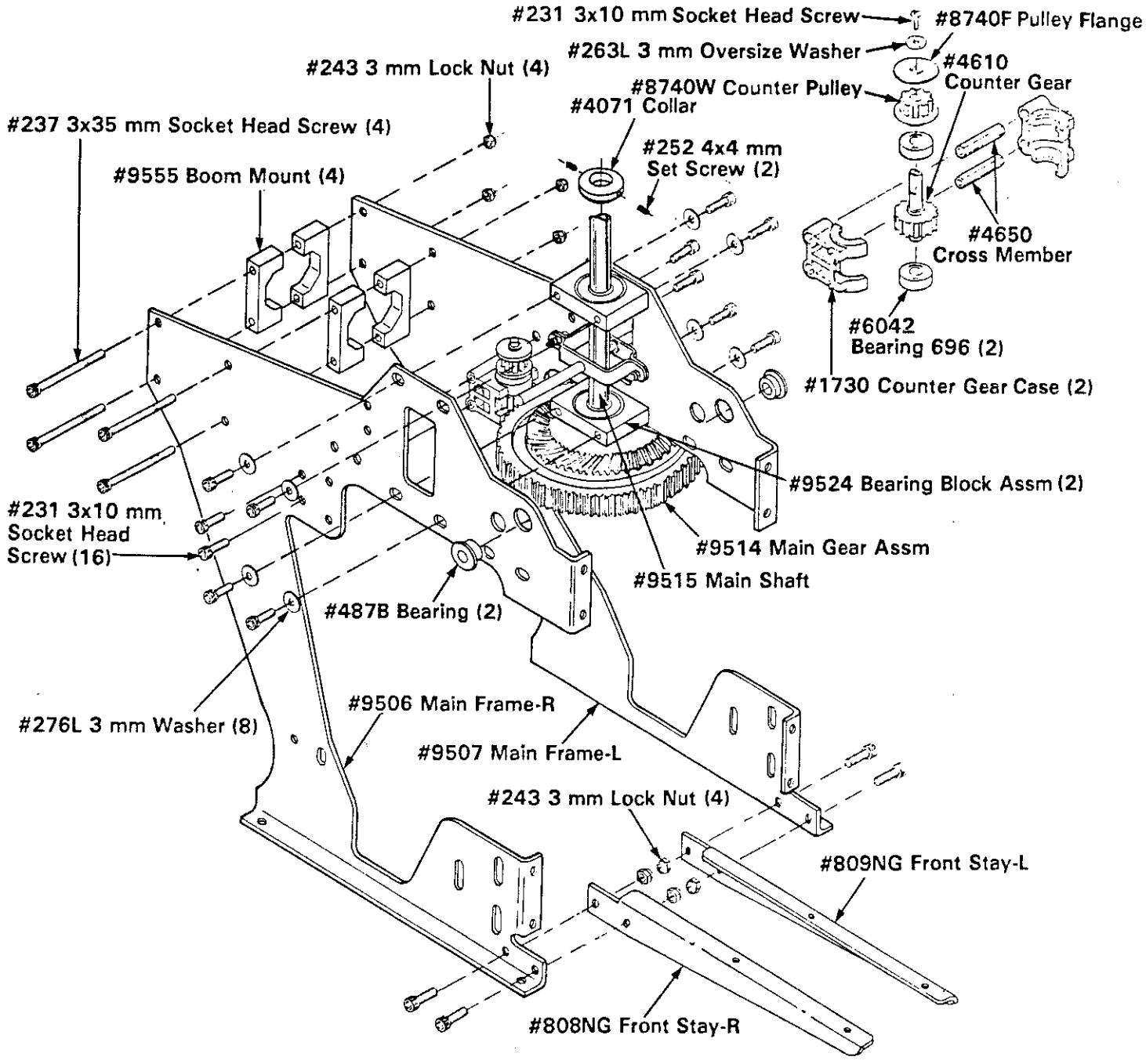
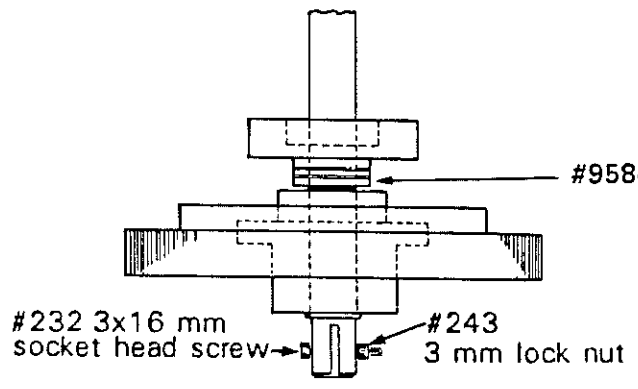


Figure 3 shows the completed landing gear assembly.

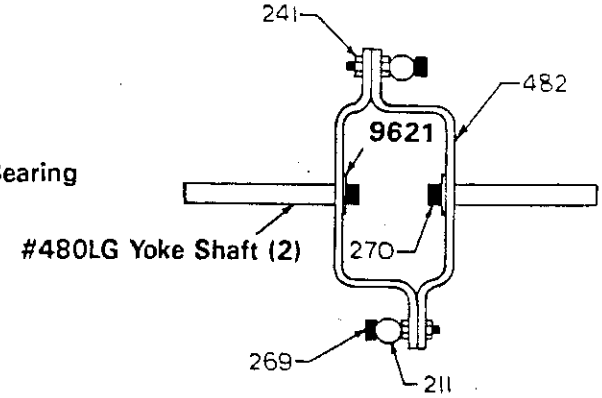
STAGE 4 MAIN CHASSIS ASSEMBLY

Figure 1 Front Belt Drive Unit





Autorotation Gear Assembly



#9480 Collective Pitch Yoke Assembly

STAGE 4 MAIN CHASSIS ASSEMBLY CONT'D - TEXT

STEP 1 BELT DRIVE UNIT

Assemble the parts shown in Figure 1 into a single unit. Put aside.

Note: It is important when assembling the 3x10 socket head screw, #231, to use Red Locktite, but do not allow the locktite to touch the surrounding plastic parts.

STEP 2 FIT FRONT STAYS

Fit the two front stays, #808NG and #809NG, onto the inside of each main frame, #9506 and #9507, as shown. Make sure that the top surface of the stays is parallel to the lower surface of the main frames. Tighten the nuts.

STEP 3 MAIN GEAR ASSEMBLY

Fit the main gear assembly, #9514, onto the lower end of the main shaft, #9515. Secure with a 3x10mm socket head screw, #231, and a 3 mm lock nut, #243. Slide the three thrust washer parts of thrust bearing, #9584, all the way down onto the main shaft. Make sure that the top and bottom parts have the grooves facing into the center ball race. Assemble the lower bearing block assembly, #9524, onto the main shaft. (Note: the exposed bearing side must be facing "up". Place the collective yoke assembly, #9480, onto the shaft. Assemble the top bearing block, #9524 , onto the shaft with the exposed bearing side also facing "up".

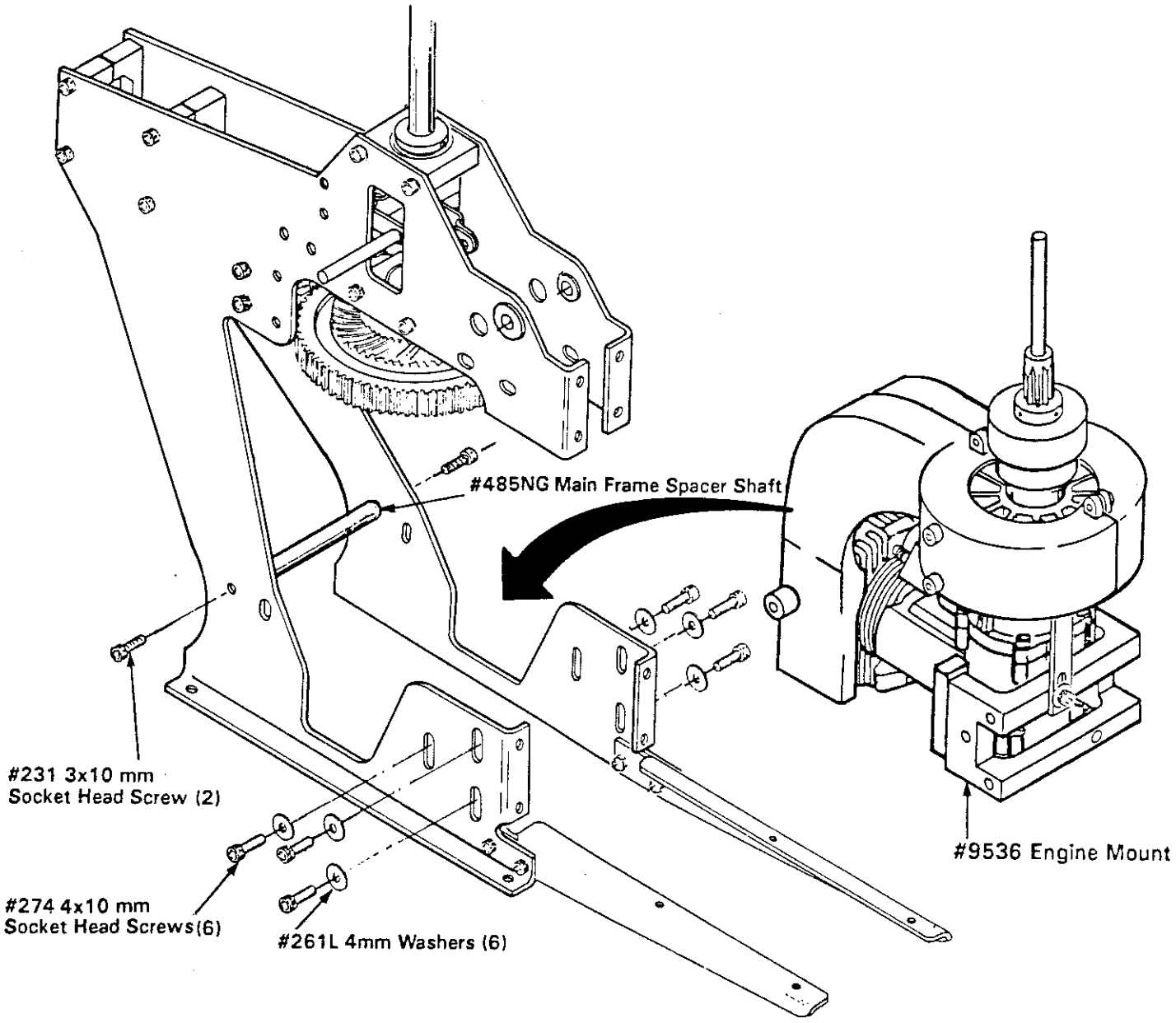
STEP 4 ASSEMBLE MAIN FRAMES

Place the main shaft, assembled in step 3, onto the left hand main frame, #9507, as shown. Secure the upper and lower bearing blocks temporarily with four 3x10 socket head screws, #231 ,(L) and a 3mm washer, #276L, under each screw head. Bring the right main frame, #9506, up to the left main frame, #9507, and fit four more 3x10 socket head screws (L) with 3mm washers through the frame into the bearing blocks. Place the belt drive unit, assembled in step 1, between the frames and secure with four 3x10mm socket head screws, #231, (L). With the main frame assembly sitting on a flat surface, tighten up all twelve 3x10mm socket head screws to secure the two main shaft bearing blocks and the belt drive unit to the frames. Fit all four tail boom mounts, #9555, between the main frames and fit the four 3x35mm socket head screws, #237, and 3mm lock nuts, #243. Do not fully tighten. This will be done after the tail boom is fitted.

STEP 5 COLLECTIVE SHAFT BEARINGS

Degrease the outer surfaces of the two #487B bearings with alcohol. Use the pitch lever shaft, #9577 (which is assembled finally in Stage 8) in this stage as a jig. Now lightly coat the outer surfaces of the two bearings, #487B, with 30 minute epoxy and fit (with flange out) into the main frames. The pitch lever shaft should be left in place until the glue dries. Wait for at least two hours and remove the pitch lever shaft for use when you commence on Stage 8.

STAGE 5
ENGINE UNIT / MAIN CHASSIS ASSEMBLY



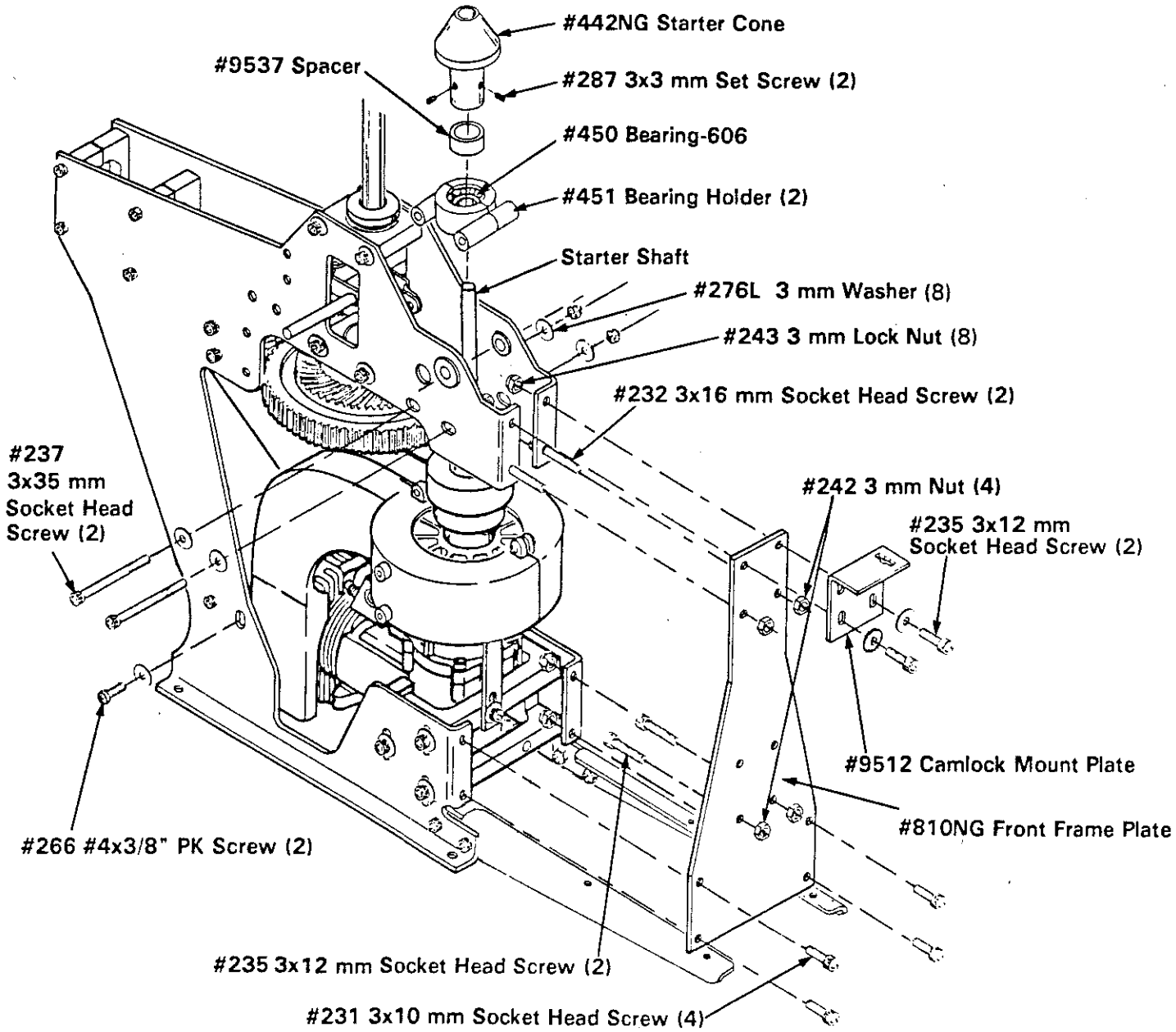
STEP 1 FIT ENGINE UNIT

In this setup we must locate the engine between the main frames. In order to do this, the frames may have to be spread open a little. When the engine is in place, the steel drive gear will locate against the main drive gear. Fit six 4x10 mm socket head screws, #274, with six 4 mm washers, #261L, and feed them through the main frames and into the engine block on both sides. Screw all six fully in but do not tighten yet or attempt to assess the correct vertical position.

STEP 2 MAIN FRAME SPACER

Fit the main frame spacer, #485NG, between the main frames and secure with two 3x10 mm socket head screws, #231 Use Loctite.

STAGE 6 MAIN CHASSIS UNIT FINAL ASSEMBLY



STEP 1 ASSEMBLE TOP BEARING BLOCK

Assemble the top clutch bearing block unit using one Bearing-606 #450 and two Bearing holders #451 and slide this unit down between the frames, over the clutch shaft. Fit the two 3x35 mm socket head screws, #237, through the main frames and bearing block. Fit 3 mm washers ,276L, and 3 mm nuts, #243, on the other side. "Snug" up the nuts but do not fully tighten yet.

STEP 2 LOCATE AND FIT ENGINE

Slide the engine unit up or down until it is positioned so that the clutch bell has 1/32" 'up and down' play. Do not try to adjust for correct mesh to the main gear yet. Now tighten the four 4x15 mm socket head screws, #239, holding the engine to the engine mount. The six screws holding the engine assembly should just be snug in this step.

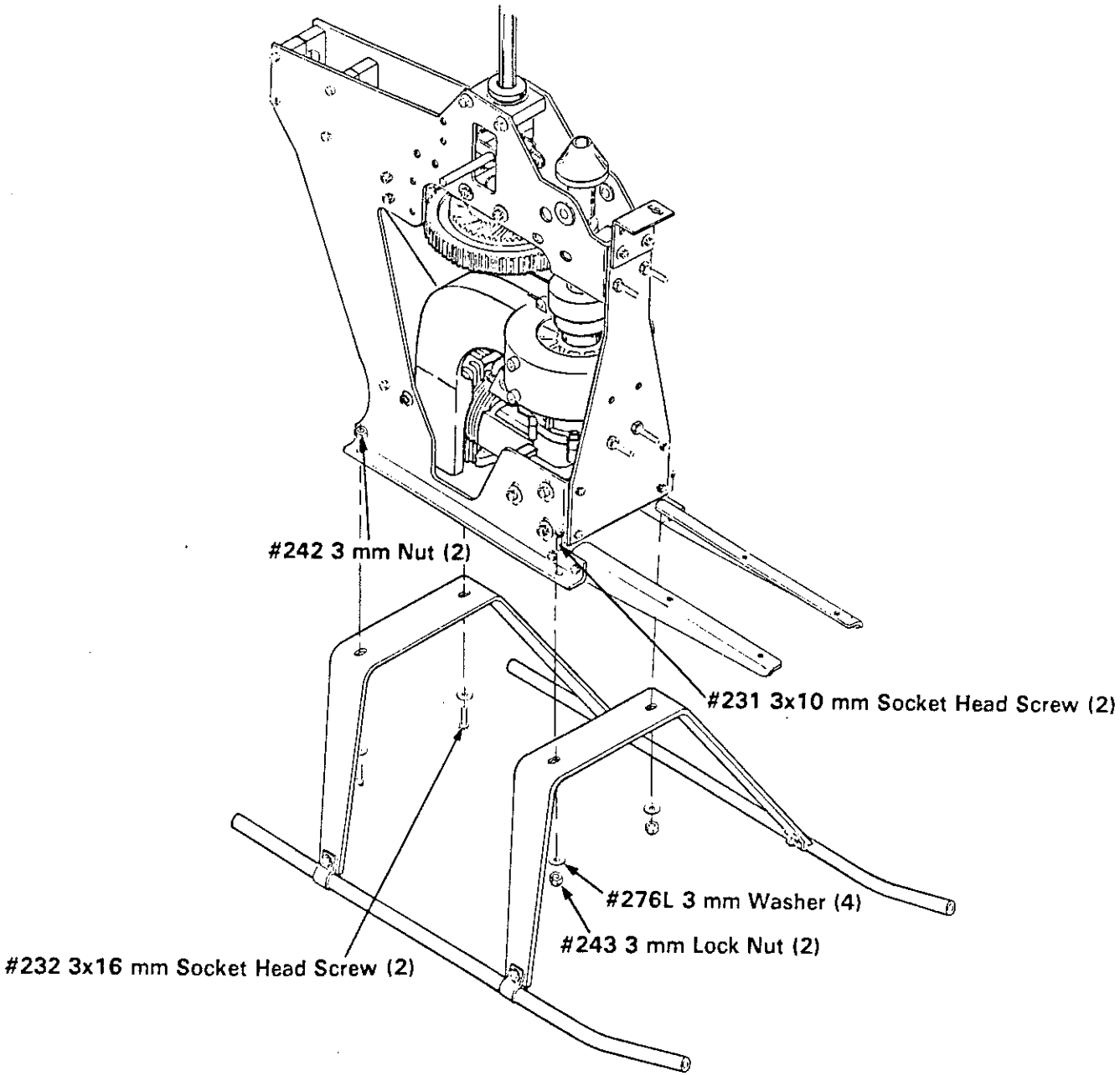
STEP 3 FIT STARTER CONE

Fit the two 3x3 mm set screws, #287, into the starter cone, #442NG, (L), but do not insert completely yet. Drop the starter cone spacer, #9537, onto the starter shaft and then fit the starter cone. Tighten the two 3 mm set screws (L).

STEP 4 ASSEMBLE FRONT PLATE

Assemble the front plate #810NG and camlock mount plate, #9512, to the main frames as shown. You will need to use a small 3 mm open ended wrench, needle nose pliers or hemostats to hold the four 3 mm nuts located inside the frame close to the engine mount. Use blue loctite wherever a plain nut is called for. Now tighten the six 4mm engine block retaining screws. Step 4 is the trickiest of the construction of the Legend, but be patient - you've nearly finished all the hard stuff.

STAGE 7
LANDING GEAR / MAIN CHASSIS ASSEMBLY

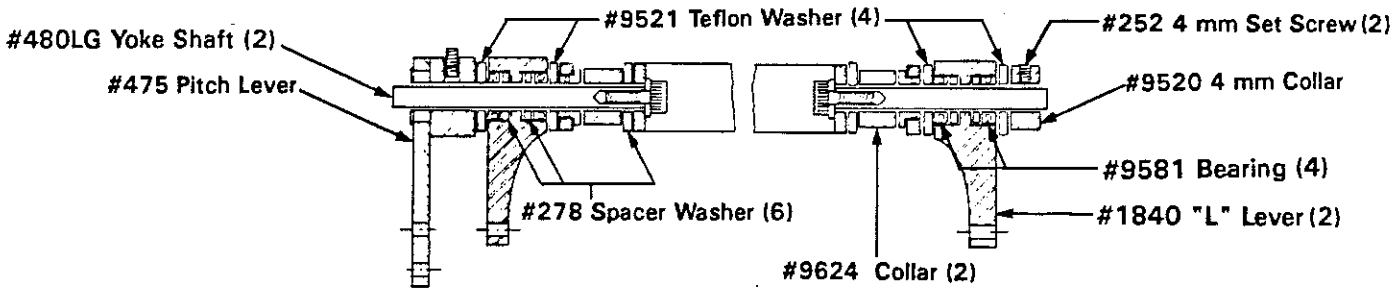


STEP 1 LANDING GEAR TO CHASSIS ASSEMBLY

Place the main chassis assembly onto the landing gear assembly. Fasten the front strut to the chassis using two 3x10 mm socket head screws, #231, 3 mm washers, #276L, and 3 mm nuts, #243, as shown. The rear struts are attached differently so that the tail boom struts may be readily attached and detached. The rear 3x16 mm socket head screws, #232, are inserted from below and plain 3 mm nuts, #242, are used to retain the gear (L). Then, when it is time to attach the strut terminals, it is much easier to do this without removing the rear screws attaching the landing gear to the main frames.

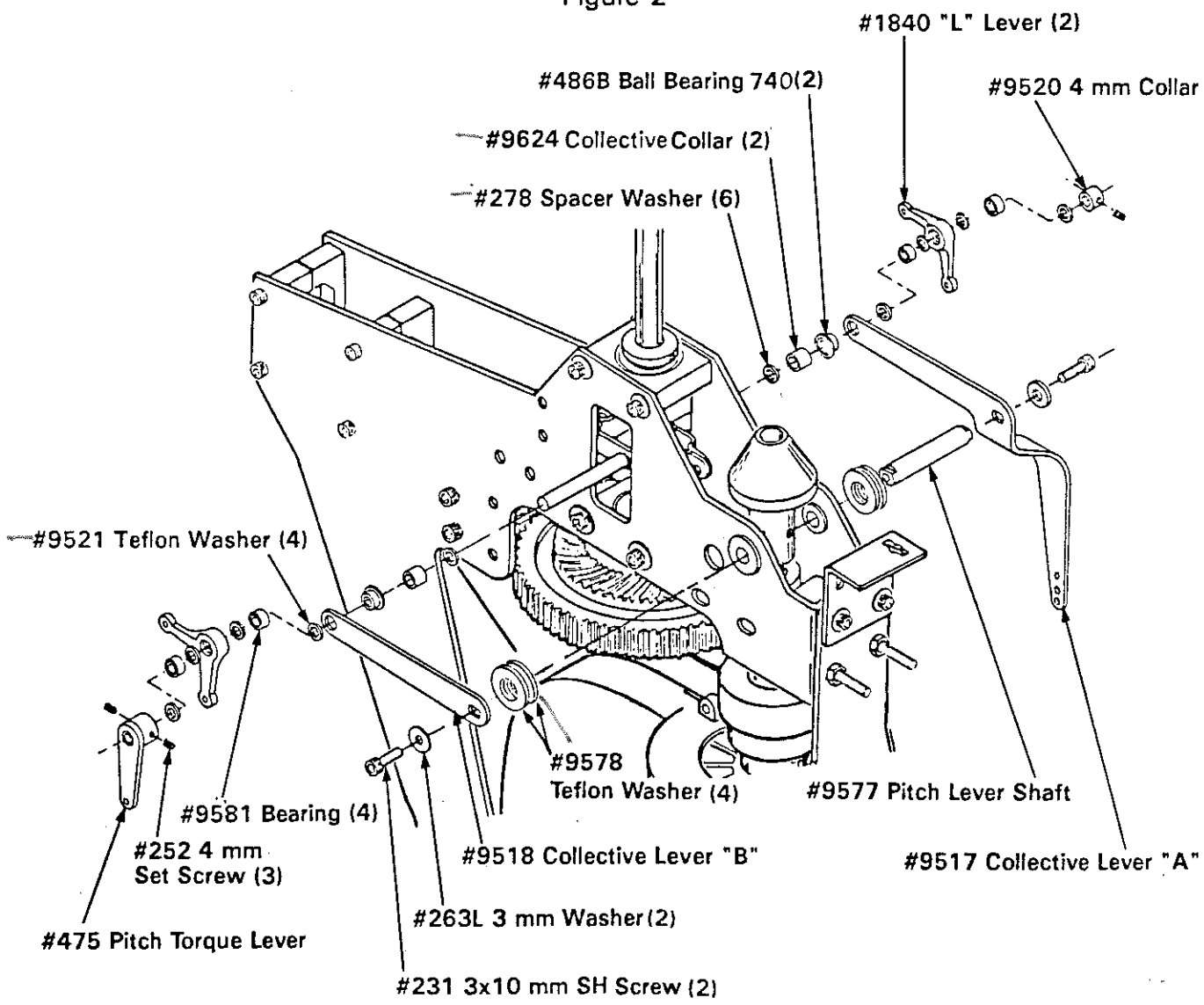
STAGE 8
CONTROL SYSTEM MECHANICAL ASSEMBLY

Figure 1



SECTION OF COLLECTIVE YOKE ASSEMBLY

Figure 2



STAGE 8
CONTROL SYSTEM MECHANICAL ASSEMBLY CONT'D - TEXT

In Stage 4 we epoxied the two bearings, #487B, into the main frame. Now its time to make one of the most important assemblies of the whole helicopter - the mechanical controls. Please note that the more care you put into this stage, the better your helicopter will perform for you and the longer it will last.

STEP 1 COLLECTIVE LEVER BEARINGS

The two bearings, #486B, should be pressed into the collective levers levers "A", #9517, and "B", #9518. Compare with the main drawing and be sure that the flanges of each bearing are on the correct side of the levers. If the bearing fit is at all loose, they must be secured by applying a little red locktite or five minute epoxy onto the outside surface of the bearings before inserting into the levers. Please be careful to avoid getting the loctite or epoxy inside the bearings.

STEP 2 ROLL LEVER BEARINGS

Fit one washer, #278 and one bearing, #9581, into each side of each roll lever, as shown in Figure 1 and the main drawing. If your bearings are flanged you should omit the washers.

Note: Flat side of roll levers face out from the helicopter (See Figure 1).

STEP 3 ASSEMBLE COLLECTIVE LEVERS

Place the pitch lever shaft, #9577, in position between the main frames as shown. Assemble the following parts onto each side of the yoke shaft in this sequence (See Figure 1):

1) #278 4x8x0.5 mm Washer

2) #9624 Collar

3) #9518 Collective Lever "B" - right side of helicopter

4) #9517 Collective Lever "A" - left side of helicopter

Locate the "D" shaped holes in levers "A" and "B" onto the ends of the collective pitch shaft, #9577, but include two special spacer washers #9578 , on each side of the helicopter between each lever inside face and the #487B bearing flanges. Fit one 3 mm washer, #263L, onto each 3 x 10 mm SH screw, #231 Loctite the threads and insert, through the "D" hole in each collective lever, into the 3 mm tapped holes in each end of the pitch lever shaft. Tighten well but be sure the "D" shaped ends of the pitch lever shaft locate properly and fully into the "D" shaped slots of the collective pitch levers "A" and "B". Check that the whole assembly rotates freely with minimum end float. Remove one or more of the teflon washers if the assembly is too tight.

STEP 4 FIT ROLL LEVERS

Place a teflon washer, #9521, on each of the yoke shafts, #480LG right and left, followed by the roll levers, completed in step 2. Note that the flat surface of each roll lever faces outwards (See Figure 2). Fit another teflon washer, #9521, followed by the collar, #9520, on the left hand side of your helicopter. Fit the last teflon washer #9521 on the right hand side and complete your assembly by adding the pitch torque lever #475.

Note: The pitch torque lever and the collar should be set in position so that there is a little play in the whole assembly each side. One easy method to ensure this is to insert a piece of thin note paper between any two of the parts and tighten the 4 mm set screw.(Use Loctite) Then (of course) remove the paper.Do the same on the other side.

You have now completed the controls assembly .

SETTING THE GEAR MESHES

The mesh (backlash) between the engine clutch gear and the main gear and the mesh between the belt drive gear and the main gear must be set. Do this as follows:

1) Check that the belt drive front unit is vertical between the frames. Retighten the 3x10mm socket head screws, #231, if necessary.

2) Slightly loosen all eight 3x10mm socket head screws, #231 which hold the two bearing blocks in place. Position the main shaft to be vertical. Place a piece of notepaper between the main gear and the front belt drive gear. Close up the gears to each other maintaining a vertical position of the main shaft. Tighten the eight 3x10 socket head screws #231.

3) Be sure all screws holding the engine block mount and the upper clutch shaft bearing are slightly loosened. Place a piece of note paper between the gears and close up the whole engine unit toward the main shaft. Tighten all screws. Don't miss any!!

4) Check that all three shafts rotate freely. If there is a high spot - redo steps 1,2, and 3 as needed. Now proceed to Stage 9 - Servo Mounting Assembly.

STAGE 9 SERVO TRAY ASSEMBLY

STEP 1 FINISH AND PAINT

Finish and paint the servo tray, #9519, and cabin floor, #9587, using your favorite finish. Color dope or polyurethane works fine.

STEP 2 FIT MOUNTING PLATE

Use the four #4x3/16" P.K. screws, #266, to fit the servo mount plate onto the rear face of the servo tray. Take care to not split the wood.

STEP 3 FIT TRAY

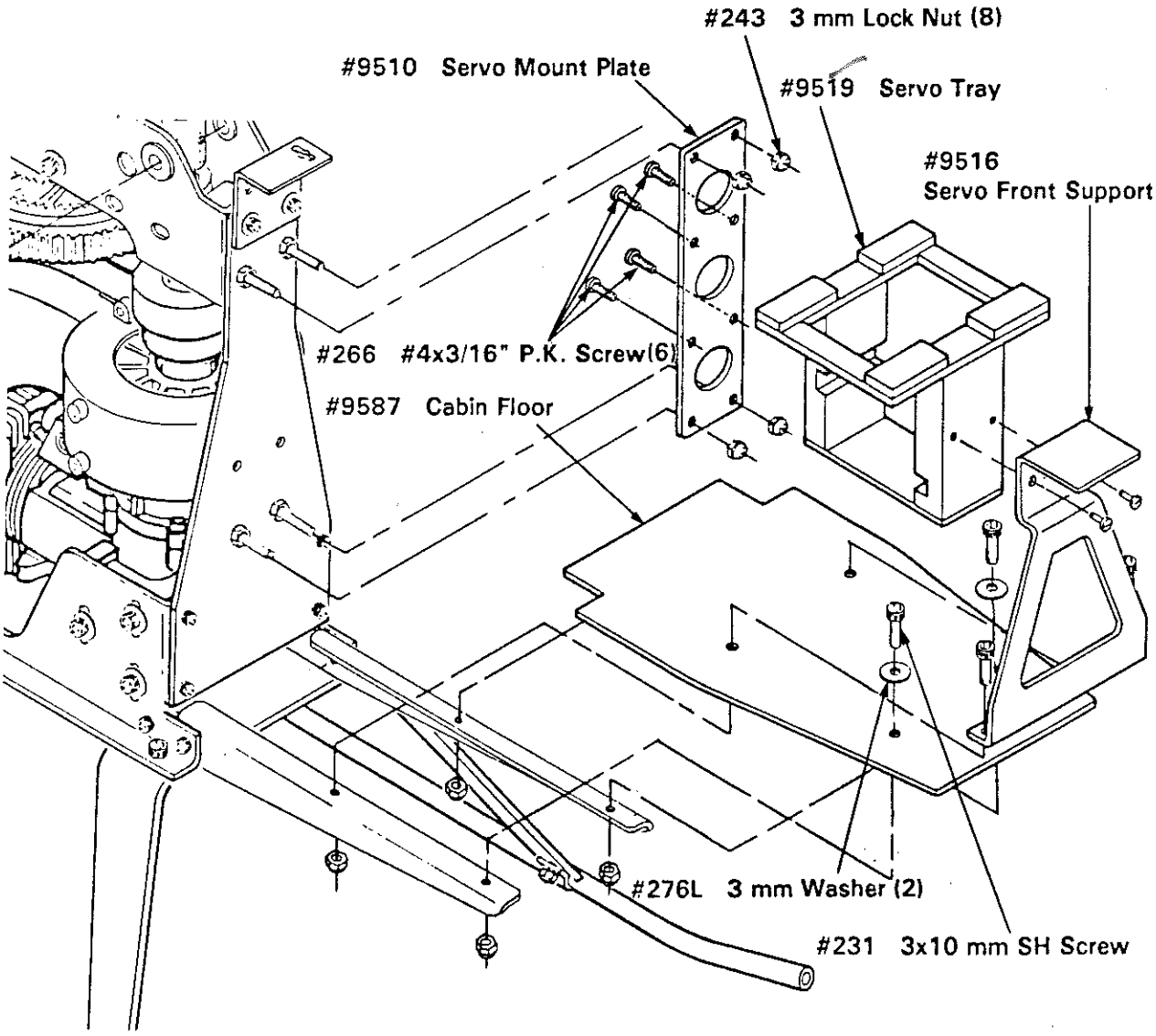
Locate the mounting plate/servo tray assembly onto the 3x10 mm socket head screws, #231, projecting from the front frame plate, as shown, and secure with four 3 mm lock nuts, #243.

STEP 4 FIT CABIN FLOOR

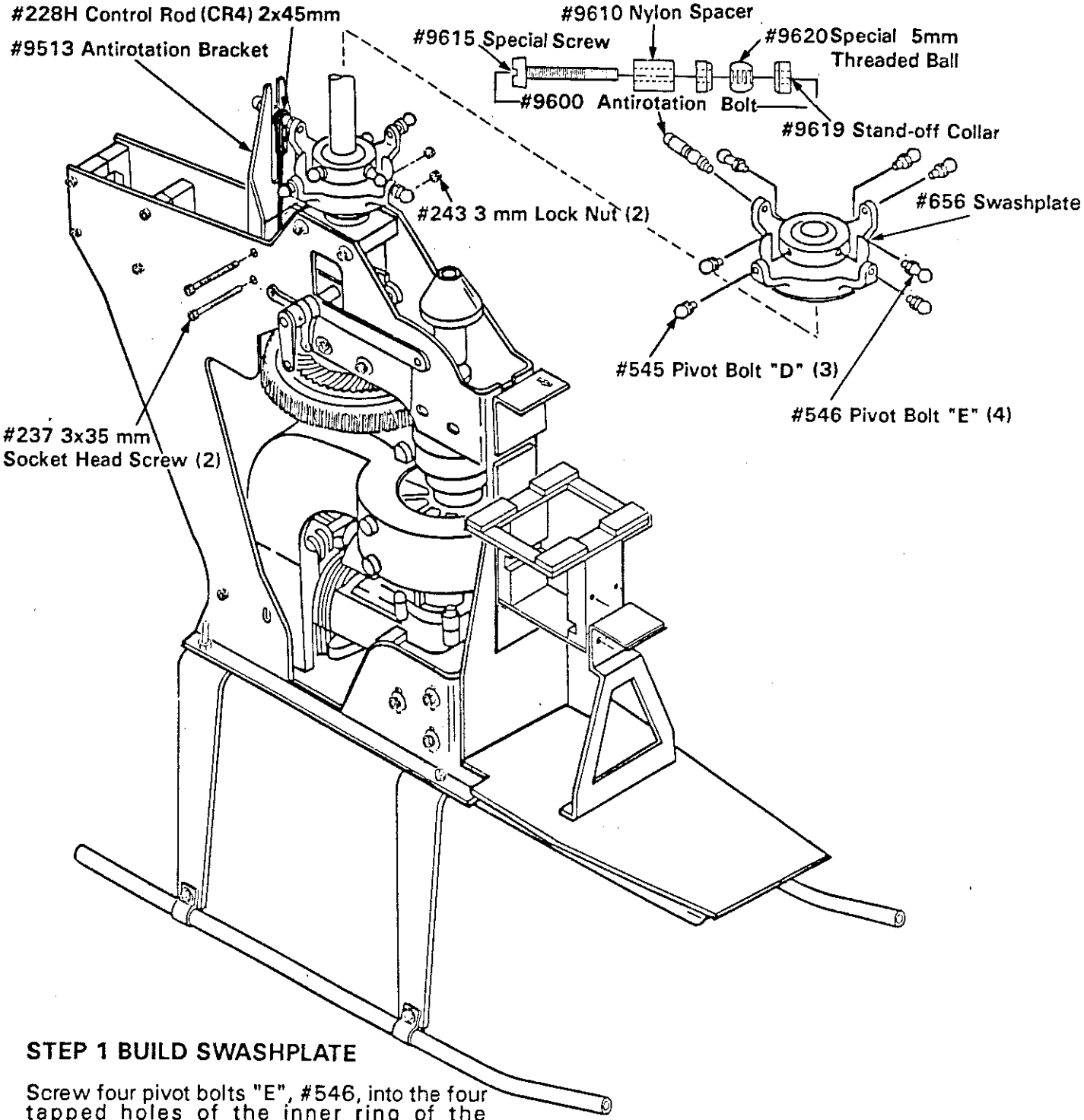
Secure the cabin floor to the front stay front holes using two 3x10 mm socket head screws, #243, two 3 mm washers, #276L, and two 3 mm lock nuts, #243.

STEP 5 FIT FRONT SERVO SUPPORT

Fit the servo front support to the cabin floor and front stays, using two 3x10 mm socket head screws, #231, two 3 mm washers, #276L, and two 3 mm lock nuts, #243. Check that the front stays are horizontal and secure the top of the servo support to the servo tray with two #4x3/16"P.K. screws #266 . Be careful to not split the wood. The horizontal part of the servo support serves as a gyro mounting platform. The "front end" of your Legend is now ready for the servo and radio installation.



STAGE 10 INSTALL SWASHPLATE UNIT



STEP 1 BUILD SWASHPLATE

Screw four pivot bolts "E", #546, into the four tapped holes of the inner ring of the swashplate. Use blue loctite and tighten the pivot bolts well. Locate one CR4, from bag #10, assemble, (refer to page 2 of the Controls manual) and then mount it onto the 3mm threaded ball, #9620,. Now, assemble the parts of the antirotation bolt as shown in the exploded view. Be sure to use blue locktite on the special screw, #9615. Tighten the screw into the threaded ball and then screw the assembly into one of the four holes in the outer ring of the swashplate (use blue loctite). Tighten well. Fit three #545 pivot bolt "D" into the remaining tapped holes in the outside ring of the swashplate.(use blue Locktite).

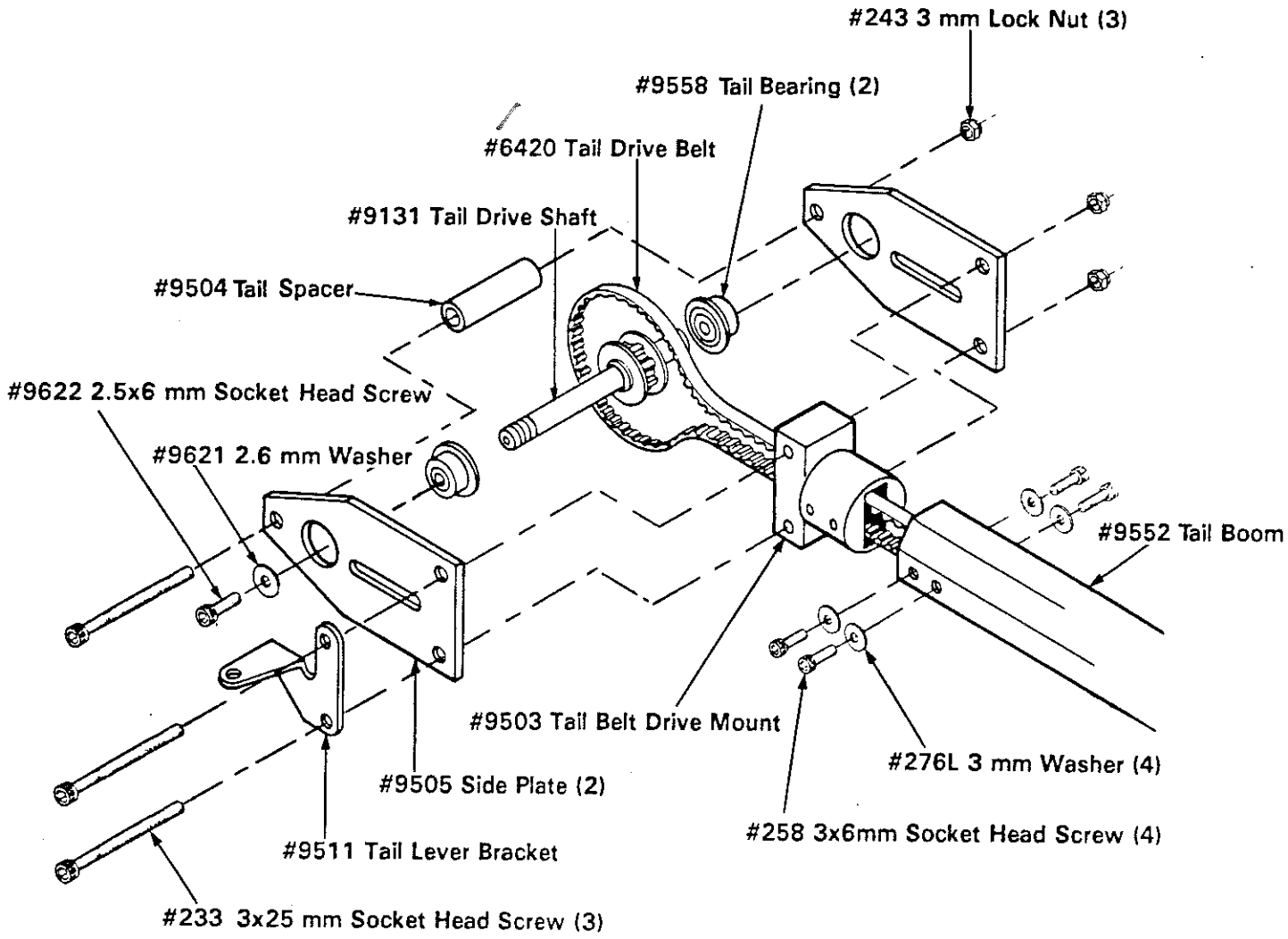
STEP 2 FIT ANTI-ROTATION BRACKET

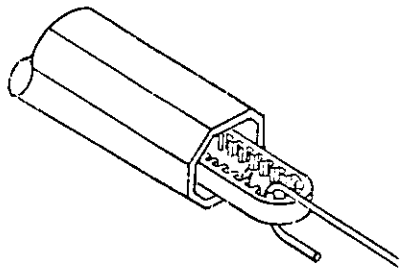
Fit the anti-rotation bracket, #9513, down between the main frames and secure with the two 3x35 mm socket head screws, #237, and 3 mm lock nuts, #243. Do not overtighten the screws or you will distort the anti-rotation bracket.

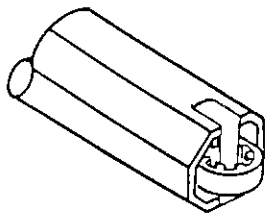
STEP 3 FIT SWASHPLATE

Slide the completed swashplate onto the main shaft and locate the antirotation bolt in the slot of the antirotation bracket. the control rods will be fitted at a later stage.

STAGE 11 TAIL ROTOR REAR DRIVE UNIT







STEP 1 FIT BEARINGS

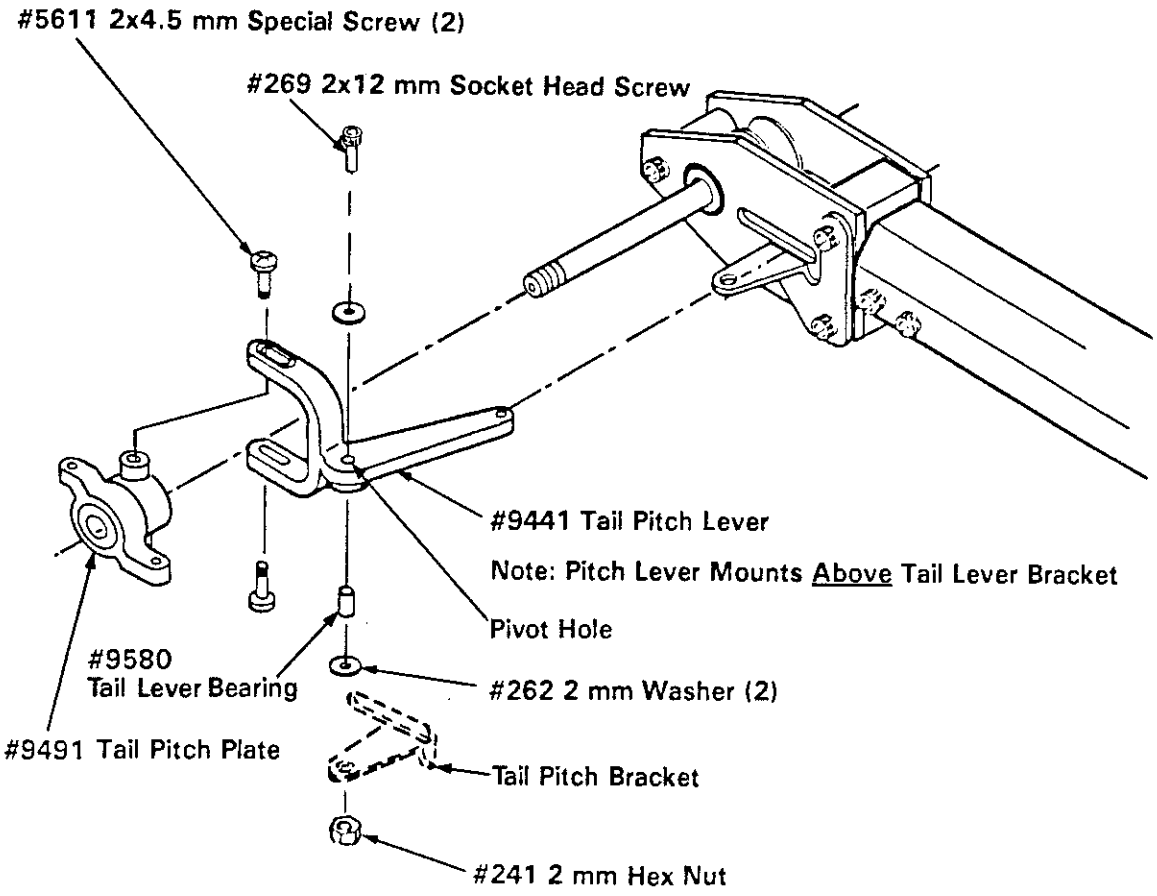
(First, disassemble the 2.5x6 mm socket head screw, #9622, and the 2.6 mm washer that came assemled to the tail drive shaft, #9131. Put them aside until Stage 12 where they will be assemled.)

Fit the two bearings, #9558, into the holes in the two tail side plates, #9505, using 30 minute epoxy. Be sure that the bearings are fitted as shown in the drawing (ie) the flange sides are on the two inside faces with both side plate slots in the lowest positions. Also make sure they are pushed in fully and are square. Let dry for at least an hour.

STEP 2 ASSEMBLE DRIVE UNIT

Feed the tail drive belt, #6420, through the tail belt drive mount, #9503, as shown. Insert the tail drive shaft, #9131 in the belt loop and fit the two side plates, #9505, with the flanges inwards. Assemble the whole unit together using the three 3x25 mm socket head screws, #233, and three 3 mm lock nuts, #243. Do not forget to include the tail lever bracket, #9511, fitted as shown in your assembly. Adjust the side plates for squareness and tighten the nuts. Check that the shaft rotates freely. Now make a hook on a 36" length of thin wire and pull the tail drive belt completely through the tail boom. Secure the end of the belt temporarily with a piece of tape.

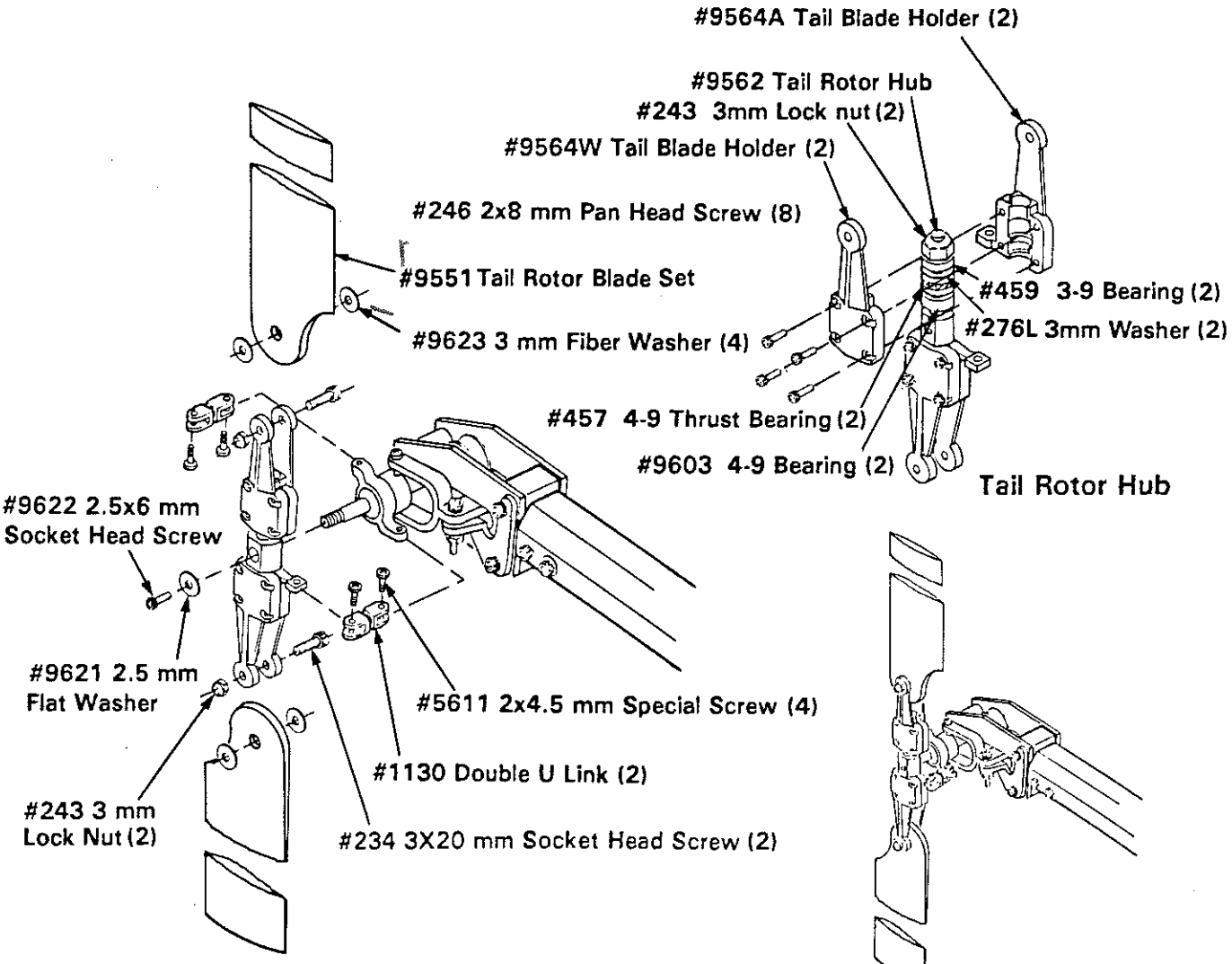
STAGE 11 TAIL ROTOR REAR DRIVE UNIT (CONT'D)



STEP 3 FIT TAIL ROTOR CONTROLS

Feed the long end of the tail pitch lever through both slots in the side plates. Position the pivot hole over the hole in the tail pitch bracket and assemble the two 2 mm washers, #262, the bronze bearing, #9580, and the 2x12 mm socket head screw, #269, as shown. Fit and tighten the 2 mm nut, #241, using blue loctite. Check that the lever pivots freely but without slop. If it is stiff, remove and trim the bottom surface of the lever just a little. Now try again. Then slide the tail pitch plate, #9491, onto the tail drive shaft and position it between the two slots of the tail pitch lever, #9441. Fit the two 2x4.5 mm special screws, #5611, by tightening gently until fully 'home', then back off one half turn. Finally, check that the whole assembly moves freely and the tail pitch lever can move to either end of the slot in the side plates.

STAGE 12
TAIL ROTOR UNIT FINAL ASSEMBLY



STEP 1 TAIL ROTOR HUB

Refer to the drawing of the tail rotor hub. Fit the four tail blade holders, #9564A and #9564W, so that there is one holder with arm and one without arm on each end. Fit the eight 2x8 mm pan head screws, #246, and tighten. Note: One blade holder has larger holes and the screws should be inserted from this side. The screws will self-tap into the other blade holder. Check that each blade holder rotates freely.

STEP 2 ASSEMBLE TAIL ROTOR HUB

Screw the assembled tail rotor hub into the tail rotor shaft (use blue loctite). Using a flat ended screwdriver in the slot at the end of the shaft to hold it, screw the hub on tightly (Note: left handed thread!) and then fit the 2.5x6 mm socket head screws, #9622, and 2.5 mm flat washer, #9621 (use locktite). Tighten well.

STEP 3 ASSEMBLY "U" LINKS

Fit the two "U" links, #1130, as shown (remove any burrs on the plastic first) with the four 2x4.5 mm special screws, #5611. Tighten each screw and back-off half a turn.

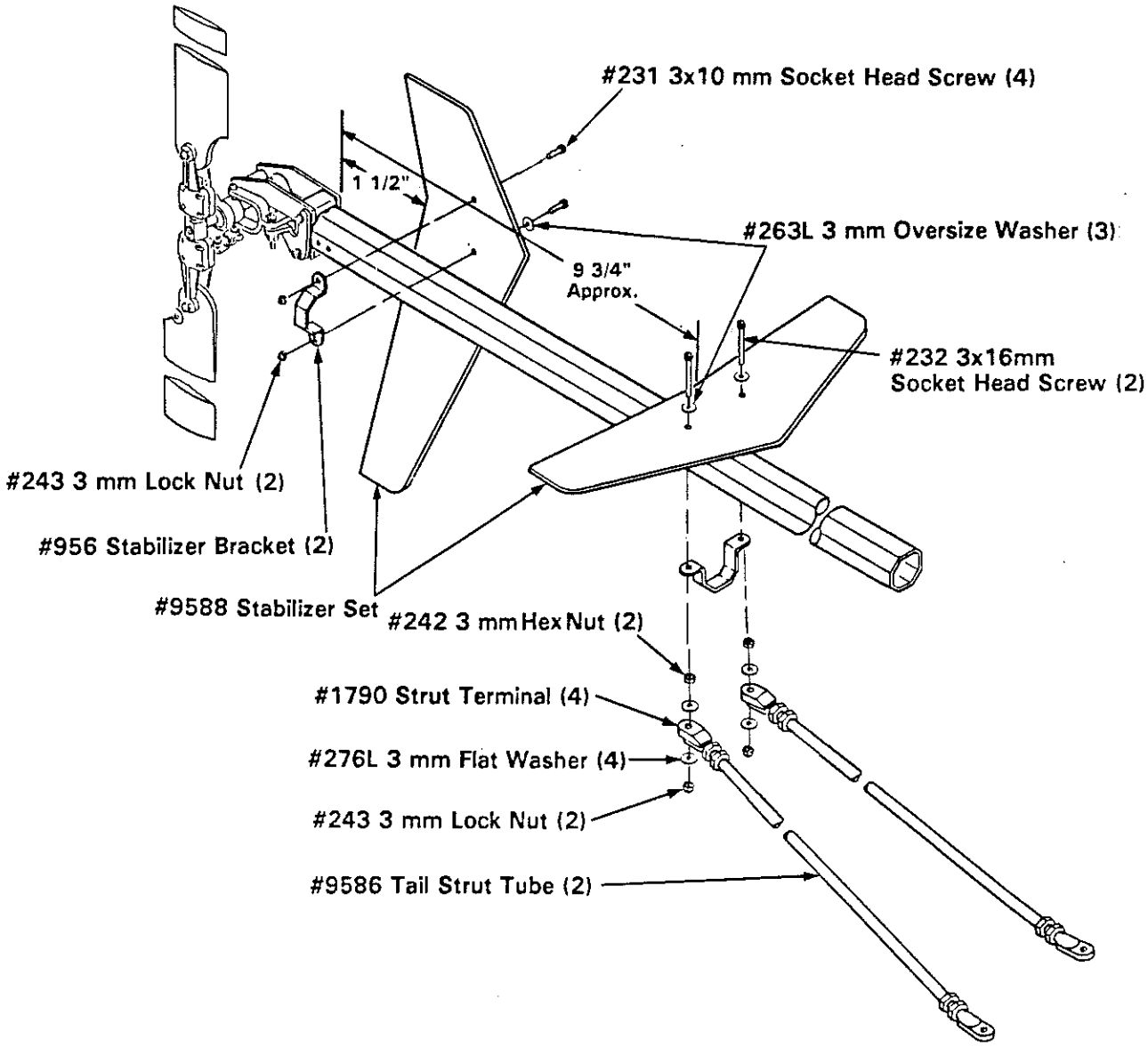
STEP 4 FIT ROTOR BLADES

Fit the two tail rotor blades, #9551, (leading edge facing direction of rotation, as shown) using the 3x20 mm socket head screws, #234, 3 mm fiber washers, #9623, and 3 mm lock nuts, #243, as shown. Tighten so that blades are free but will not fall freely by their own weight.

STEP 5 TEST TAIL UNIT

Check that the whole tail unit rotates freely and the control arm moves easily to each end of the slot in the side plates. If not,locate the source of the binding and do that step again..

STAGE 13 FINAL ASSEMBLY OF TAIL SECTION



Note: This Stage May Be Done Now Or After Tail Boom Is Fited To The Main Chassis.

STEP 1 PREPARE TAIL SURFACES

Round off the corners and edges of the vertical fin and horizontal stabilizer. Sand lightly all over. Fill grain and surfaces with your favorite filler. (Use "Hot Stuff" on all edges before sanding.) Paint with your favorite finish and put aside to dry. Decorate with the decals provided after drying.

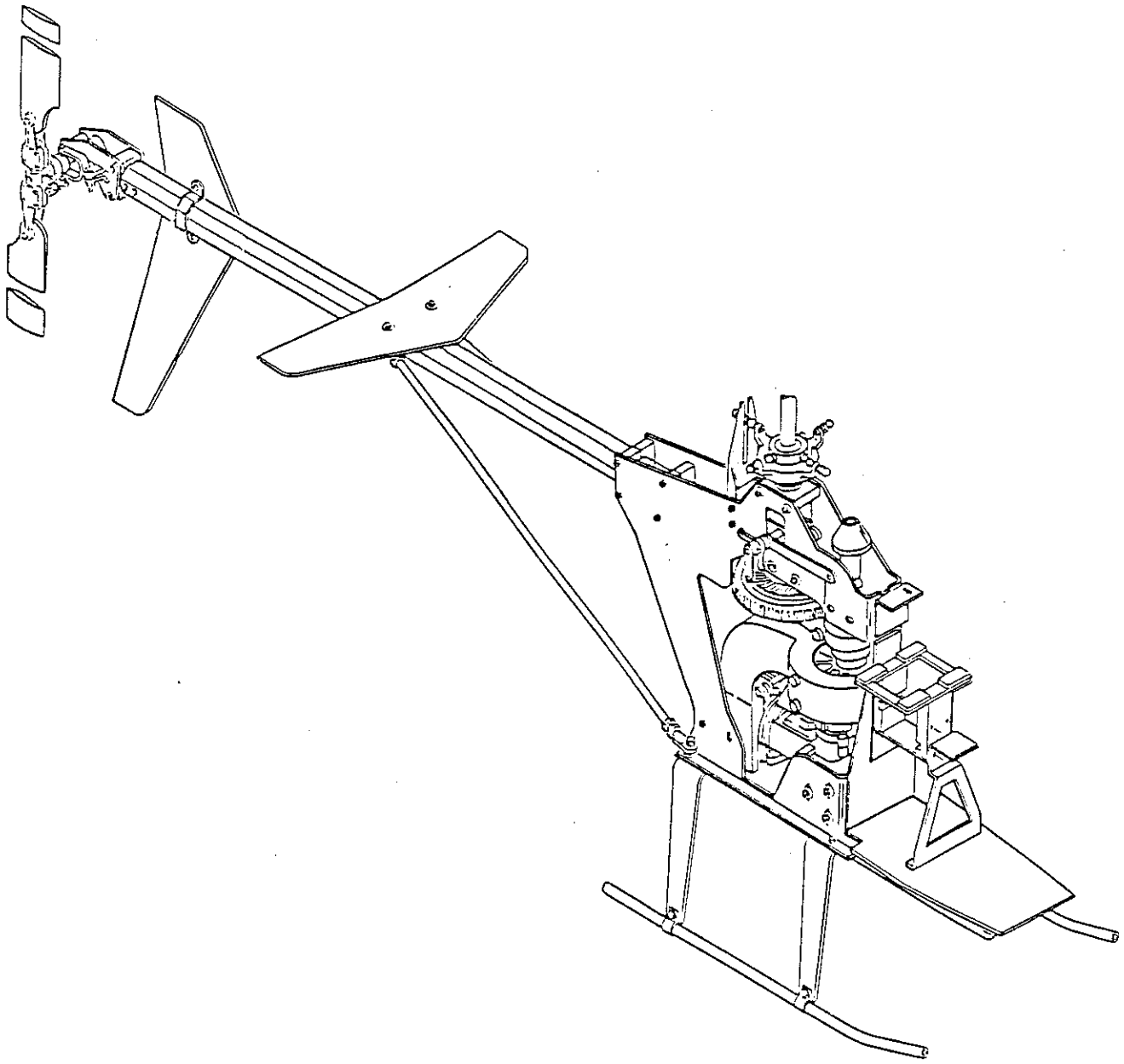
STEP 2 PREPARE TAIL STRUTS

Fit the four plastic terminals, #1790, into the two tail struts, #9586. The flat surfaces of each end should face 180 degrees from each other.

STEP 3 FIT STABILIZERS

Fit the vertical and horizontal stabilizers, #9588, as shown. Take care not to tighten the 3 mm lock nuts, #243, too much in order to avoid crushing the "Magnalite" sheet. The vertical fin can be fitted finally but the horizontal may need to be moved when the whole tail unit is fitted to the main chassis. When this is done, a small amount of silicone between the boom and the underside of the horizontal stabilizer is a good idea.

STAGE 14 COMPLETE TAIL SECTION ASSEMBLY



STEP 1 PREPARE TAIL ASSEMBLY

Remove the belt retaining tape which you added in Stage 11. Sight down the boom from the chassis end and be sure that the tail drive belt is not twisted - this is very important. Leave the belt end protruding from the boom. Be careful not to lose it!

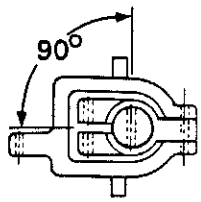
STEP 2 ATTACH TAIL ASSEMBLY

Twist the belt end 90 degrees clockwise (looking into the tail tube). Slide the end of the tail boom through both sets of boom clamps, and position the tail assembly as shown. You may have to loosen the boom clamp bolts and part the frames with your hands so that the boom end will pass through the clamps easily. Now drop the belt over the tail drive pulley. Check that you have done this correctly by turning the main shaft clockwise (viewed from above). The tail rotor should rotate anti-clockwise, looking at it from the tail blade side (right side) of the helicopter.

STEP 3 ADJUST TAIL BOOM

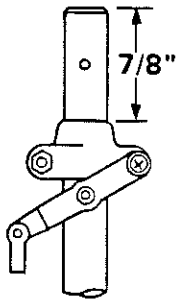
Slide the tail boom backwards, and then test the belt tightness by pushing it inwards with your little pinky or the end of a pencil. The belt should be reasonably taut but not tight. It certainly should not 'twang' like a guitar string, nor be so slack that very little pressure is needed to deflect it.

STAGE 15 ASSEMBLE AND FIT CARRIER UNIT



TOP VIEW

FIGURE 2



SIDE VIEW

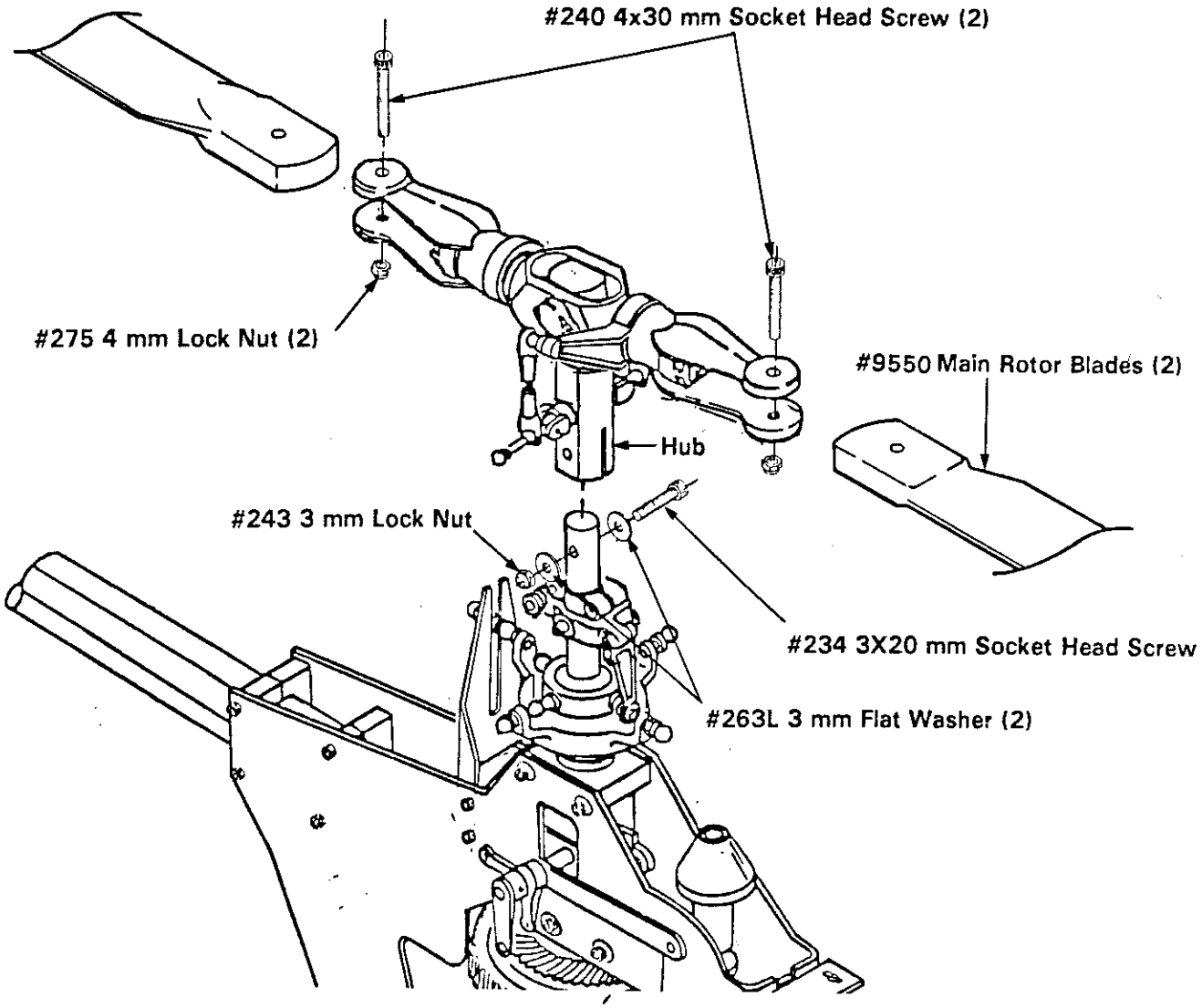
FIGURE 1

STEP 1 SWASHPLATE CARRIER UNIT

Fit the radiius arm, #512, to the pivot arm, #510, using the needle pin, #566. Press the pin right through and center it using a vise or a large pair of pliers. Fit this assembly to the mast lock, #509, as shown in Figure 1. Use a small amount of cyanoacrylate glue on the 2mm hex nut, #241, after tightening. Finally, be sure to check that the pivot arm, #510, pivots freely on the mast lock, #509.

Fit the whole assembly onto the main shaft, #9515, and secure in the position shown in Figure 2, using the 3x10mm pan head screw, #223, and the 3mm nut, #242. Do not use loctite on any hardware which contacts plastic parts.

STAGE 16 FIT ROTOR HEAD SYSTEM



STEP 1 FIT ROTOR HEAD

Push the main rotor head onto the main shaft and align the hole in the hub with the hole in the main shaft. Note: it is sometimes helpful to use a rod slightly less diameter than 3 mm to align the two parts. A 3 mm hex wrench works well. Insert the 3x20 mm socket head screw, #234, fitted with a 3 mm flat washer, #263L, and secure with another 3 mm flat washer, #263L, and a 3 mm lock nut, #243. Tighten firmly but do not overtorque.

STEP 2 FIT MAIN ROTOR BLADES

This step may be delayed for convenience in carrying out later steps, but do not forget to do it before you commence flying! Fit each blade into the blade holders and secure with a 4x30 mm socket head screw, #240, and a 4 mm lock nut, #275. Check that the blades can pivot freely without binding - then tighten the retaining bolt enough so that the blade can be "swung" with just a small amount of friction. It should be just tight enough so that it will not fall by its own weight when the helicopter is tilted about 45 degrees.

STAGE 17 CABIN ASSEMBLY

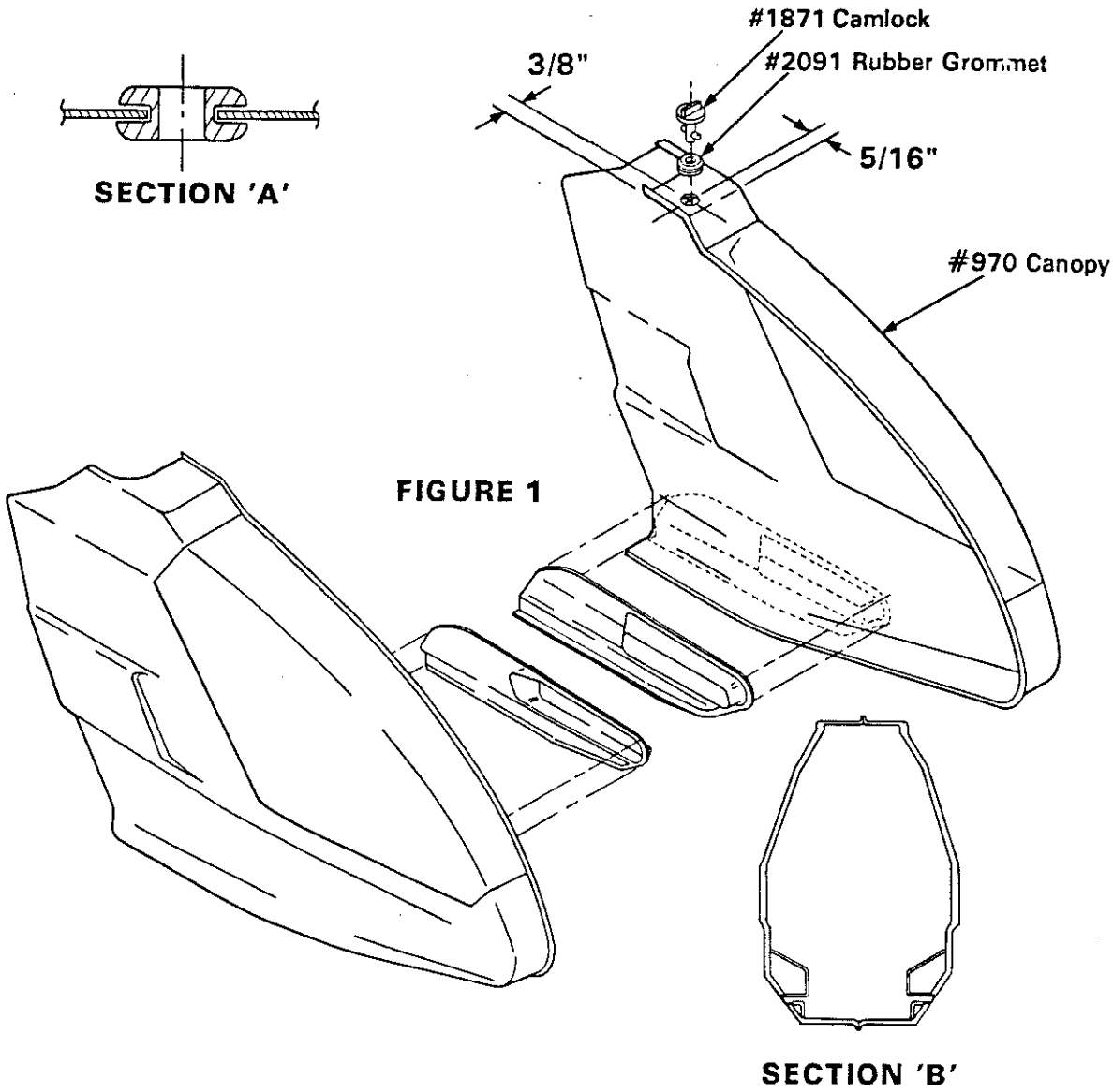


FIGURE 1

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 type 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.

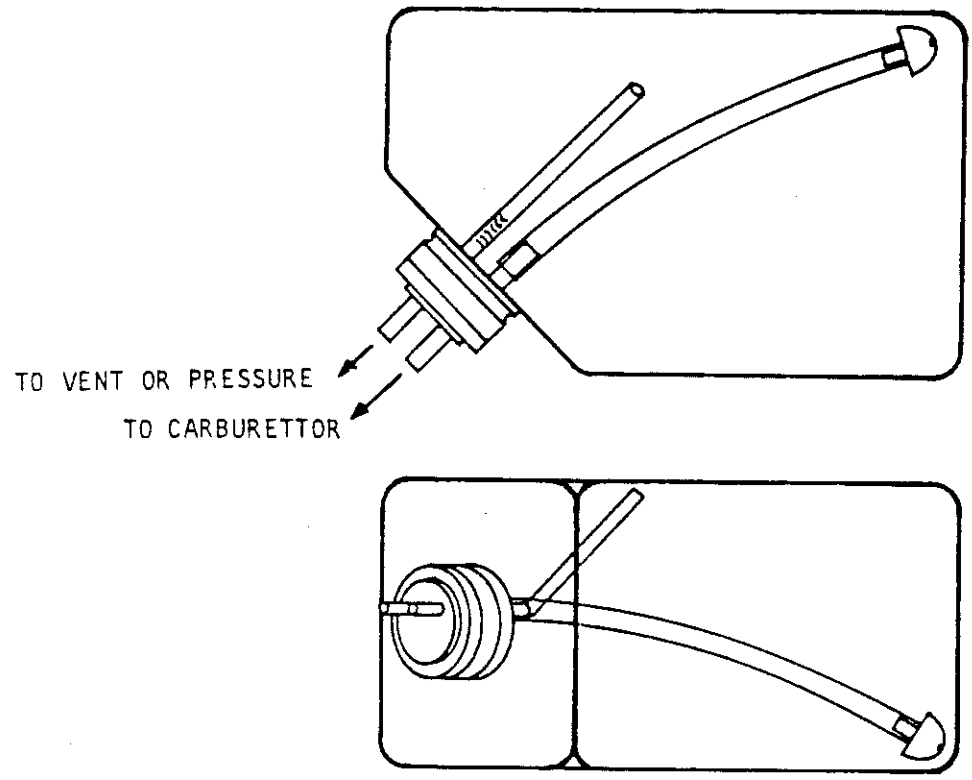
STEP 5 DRILL HOLE

Drill a 3/16" (5mm) diameter hole in the cabin top as shown in Figure 1. Carefully open up the hole to 7/16" (11mm)diameter. A taper reamer (1/8" to 1/2") (3mm to 12mm) sold in most hardware stores, is a useful tool to do this. Trim the edges of the hole with a modelling knife and fit the grommet as shown in Section 'A'.

STEP 6 PAINT

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

STAGE 18 FUEL TANK ASSEMBLY



FUEL TANK #559

INSTALL FUEL TANK SYSTEM

The Fuel Tank is a kit box item. It contains all the tubes and fittings you will need to assemble the tank unit.

Obtain 1 foot of medium size fuel tubing and a fuel filter from the hobby store.

1) Remove contents of fuel tank.

2) Insert two aluminum tubes into cap. 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 of the tank when the plug and cap is in place. Fit the other tube so that about 1/2" extends inside the cap. Connect a 3 inch piece of the silicon fuel line to this 1/2" end and the clunk to other end. Make sure that the clunk falls onto the floor of the tank by its own weight. If it does not, you may need to use a more pliable fuel tubing.

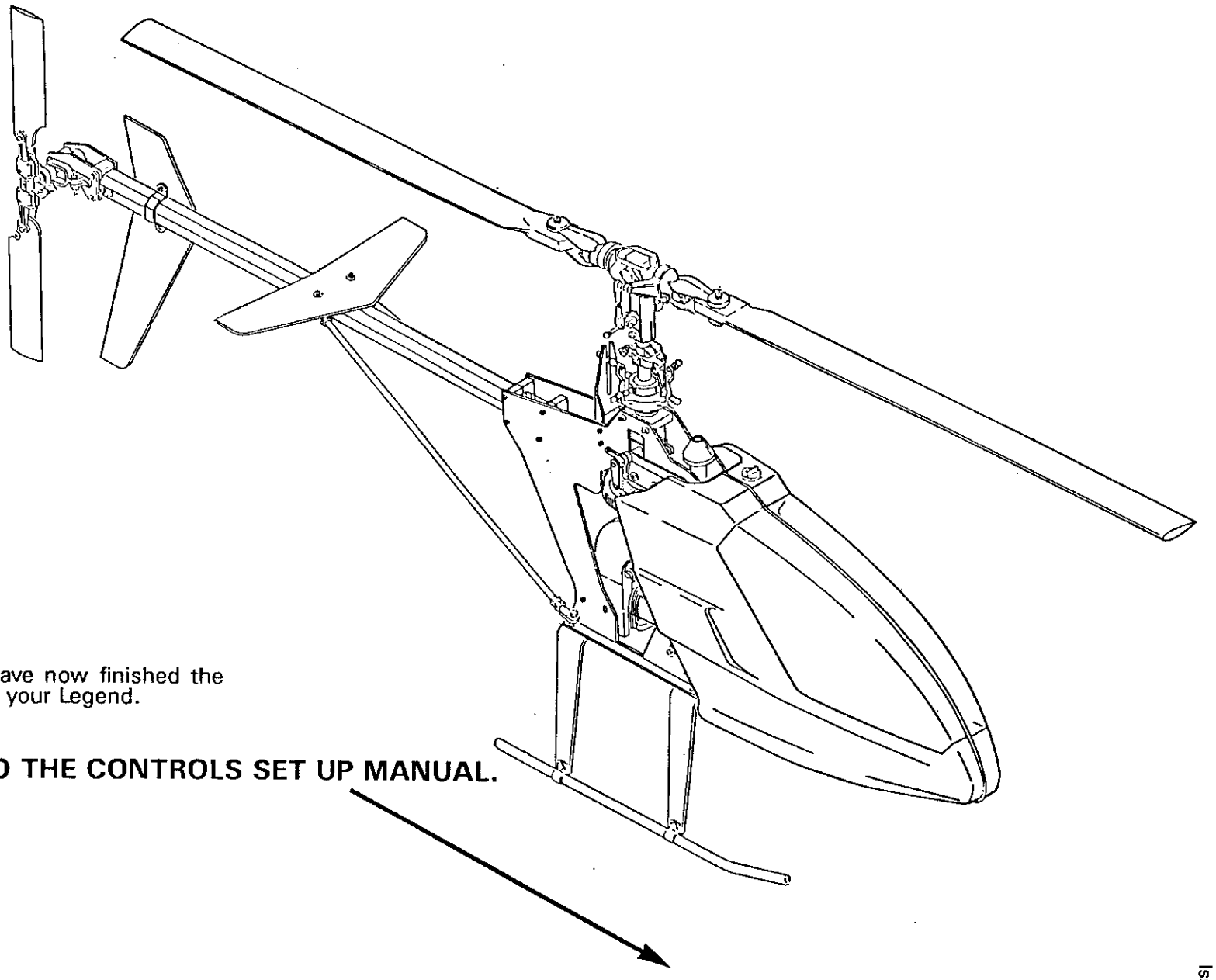
3) Insert the rubber plug and tubes into the tank making sure that the vent tube is close to the top of the tank. Fit the metal cap firmly onto the tank neck.

4) The vent tube can be connected to a muffler pressure fitting if desired.

5) Mount the complete tank on to the 1/16" plywood floor of the front cabin under the servo mount unit and to the rear of the space available. A small amount of silicone may be put between the tank lower surface and the plywood floor. Pack some rubber tape between the top surface of the tank and the lower surface of the servo mount unit if needed. Also it is desirable to fit two strips of rubber tape between the rear surface of the tank and the front frame of the chassis to prevent chafing.

6). Connect the vent tube to the muffler pressure nipple or leave about three inches of fuel tubing open ended to vent the tank. Connect the other (feed) tube to the carburettor via a piece of fuel tubing with a fuel filter included in the line.

STAGE 19 FINAL MECHANICAL ASSEMBLY



Congratulations - You have now finished the mechanical assembly of your Legend.

NOW PROCEED TO THE CONTROLS SET UP MANUAL.

LEGEND

MAIN ROTOR BLADES MANUAL

Important - Please Read Before Finishing Main Rotor Blades

Issue 3

GORHAM MODEL PRODUCTS, INC.,
Calabasas, California USA

STAGE 1 MAIN ROTOR BLADES

Figure 1 Basic Geometry Of The Legend Rotor Blade

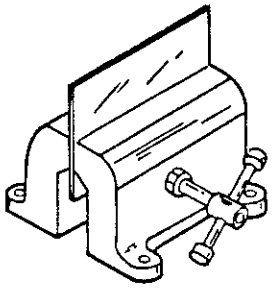


Figure 2 Metal Balancing Fulcrum

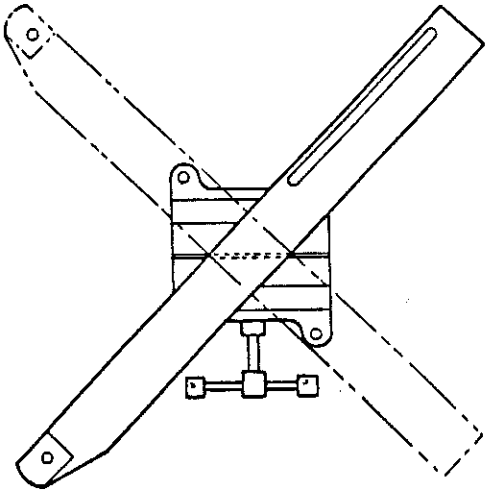


Figure 3 Locate C.G. Of Each Blade

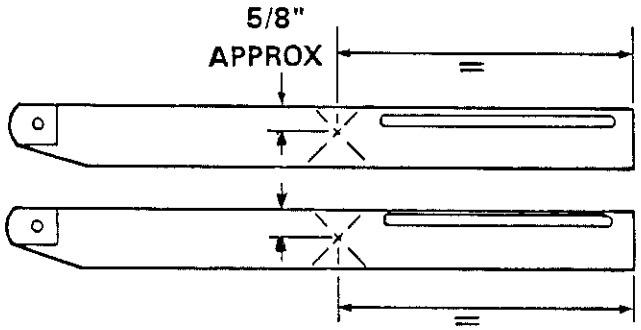


Figure 4 Compare C.G. Positions

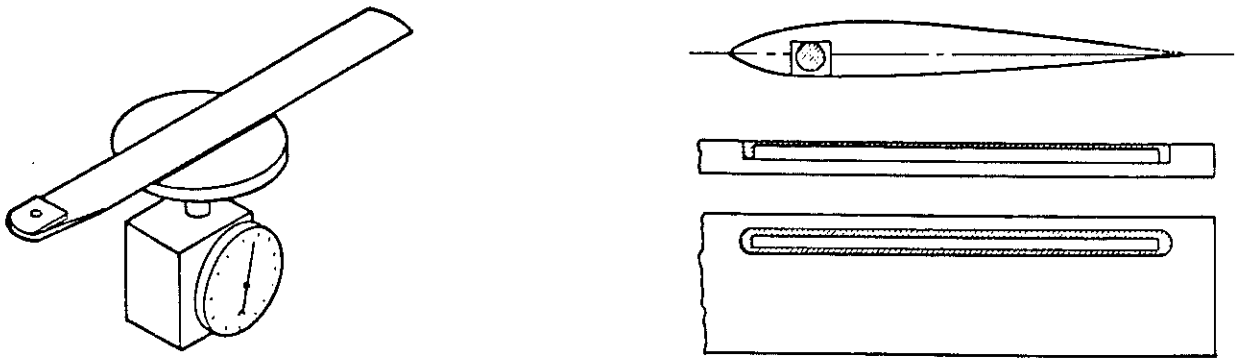


Figure 5 Adjust C.G. Position And Blade Weight

STAGE 1 MAIN ROTOR BLADES

FINISHING AND COVERING

The rotor blades included in your Legend kit are specifically designed, selected and matched for use with the GMP Legend line of RC helicopters. They have two unique qualities which the Legend owner should be aware of.

First, the geometry of the blades has been carefully chosen by GMP to be the best possible match for the Legend helicopter. The pivot hole is located very specifically at 30% of mean chord, which is about 5/8" from the leading edge. The pivot hole is also located 1" or more from the rotor hub blade end.

This is very important since the correct location of this attachment point, in conjuction with the proper location of the C.G. (Center of Gravity) of the blades, will greatly influence the performance of your helicopter. This is especially true if you are flying the flybarless Legend. The weight of your Legend main rotor blades, plus the distribution of this weight, is also an important factor in ensuring good performance.

GMP has carefully selected the weight of your main rotor blades to fall within a very close range. The slot on the underside of the blade is provided for the additional weight you wish to add (provided in the kit) in order to customize them to your specifications.

For flybarless head use, the finished blades should weigh 165 - 175 grams (5.8 - 6.2 ounces). A rotor blade lighter than 165 grams will give you very quick response and should only be used by the expert 'hot-dogger'. 155 grams would be a minimum weight since less is almost too fast for a normal human responces.

On the other hand, 175 grams will provide very smooth flight performance and will handle gusty conditions a little better and also improve autorotations. Autorotations are so good with the flybarless head, however, that any weight between 160 - 170 grams still give superior performance to that obtainable with a flybar type rotor head. We DO NOT ADVISE a blade weight over 175 grams, or a head speed of more than 1850 RPM, since the pull on each blade will then be over 700 pounds and the safety factor of the whole blade will fall below an acceptable level. So do not weight up GMP blades to over 175 grams or run the head faster than 1850 RPM.

Figures 1 thru 5 shows the procedure for weighting and finishing your main rotor blades. The recommended procedure is as follows:

1. Determine the C.G. position on each blade, as shown in Figure -1. Place each blade at an angle of 45 degrees on top of a thin sheet of metal fixed in a vise. Move the blade around until it balances and then press down to cause a mark on the blade. Then carry out the whole procedure again with the second blade.

2. Place the blades side by side and confirm that the C.G. positions are within 1/16".

3. If the C.G. positions vary more than 1/16", then correct as shown in 5 below.

4. Weigh each blade with the slot 95% full of the lead provided (you may have to cut a little off first). Allow 8 grams for covering and 5 grams for epoxy on each blade. Trim the lead so that each blade is of equal weight and will fall within the range of 152 - 162 grams.

5. If the C.G. needs to be adjusted, do this by moving the lead weights in the slots (sideways or lengthwise) and tack the lead in place with '10 second' glue.

6. Fill the slot cavity with '30 minute' epoxy (using micro balloons and epoxy, mixed, if you wish) and wait at least 4 hours before proceeding.

7. Sand the surface of the slot flush.

8. Cover each blade with heat shrink tubing as shown.

9. Put a decal or strip of colored vinyl on the end of <u>one</u> blade.

10. Fit decals to each blade as desired.

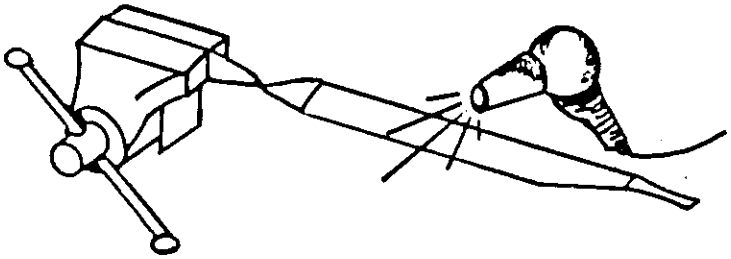
11. Recheck that your rotor blades have equal weight. If not add a small piece of vinyl tape on the underside of the lighter blade at the C.G. position. Repeat as needed.

Stage 1 (Cont'd)

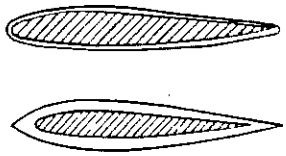
COVER MAIN ROTOR BLADES

Place covering on blade

Use heat gun



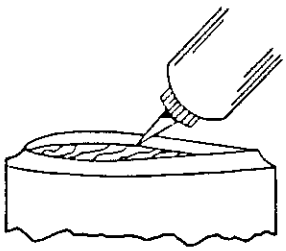
or steam shrink covering



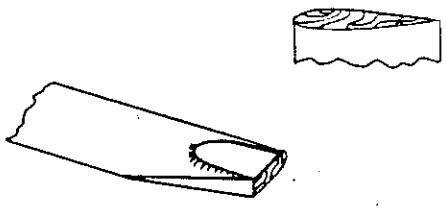
Hold one end in vice

Pull other end

Shrinking complete



Seal both ends with cyanoacrylate glue



Trim edges (lightly sand if desired)