MORLEY HELICOPTERS

BELL 47G

INSTRUCTION MANUAL

PLEASE READ CAREFULLY

BEFORE ASSEMBLY

MORLEY HELICOPTERS

BELL 47G

SPECIFICATIONS

1/9 semi-scale model Bell 47G helicopter

Length (less rotor)	44in.	1118mm
Rotor diameter	45in	1143mm
Main rotor rpm	approx 1150	
Main Rotor	Morley 'AT' collective head	
Engine		
(with ballraced crankshaft)	.40 cu in	6.5cc
Radio	minimum four/five channel prooprtional for	
	main rotor collective/throttle (1 or 2)	
	main rotor cyclic (2)	
	tail rotor pitch	
Fuel capacity	8 fl oz (250 cc) in tank supplied	
Flying weight (approx)	7.5lbs	3.4Kg

Dear Customer,

Thank you for choosing a 'Morley' helicopter. We hope you enjoy making a successful model.

A helicopter is a most fascinating machine, and exciting to fly, but it does need care and persistence to become successful and enjoy the model's performance capabilities.

This model is an attractive representation of what to some people is *the* helicopter. The Bell 47G was the first helicopter to be widely used, It was manufactured in several countries and has a very long service history.

Your model is built around the Morley Mk 3 mechanics and therefore has many parts in common with other helicopter models in the 'Morley' range. It should serve you well and we wish you many happy landings.

Jim Morley

ADDITIONAL NOTES TO BE USED IN CONJUNCTION WITH THE BELL 47G INSTRUCTIONS.

PLEASE READ CAREFULLY BEFORE BEGINNING CONSTRUCTION.

Ref. pages 3/4.

We now include a cork disc and a shake-proof washer for the engine/flywheel/pulley assembly. The cork disc fits on the engine, between the prop-driver and the flywheel. The shake-proof washer is fitted between the pulley and the crankshaft nut. Using this revised method of assembly means that there is no need to apply any kind of locking compound. Subsequent flywheel removal is also much easier.

Ref. pages 3/4.

The fan duct is now supplied as used, there is no need for any modifications.

Ref. page 5.

The plain shank 30 m.m. bolt (12) has now been replaced by a full threaded version. Adjust the position of the two nuts to remove any free play in the bellcrank.

Ref. page 6.

The M4 X 20 m.m. socket set screws have been replaced by 4 X 18 m.m. socket set screws. there is no need to remove any excess.

Ref. page 12.

The swashplate is now pre-assembled for you, however the full assembly instructions have been left in for any future maintenance.

Ref page16.

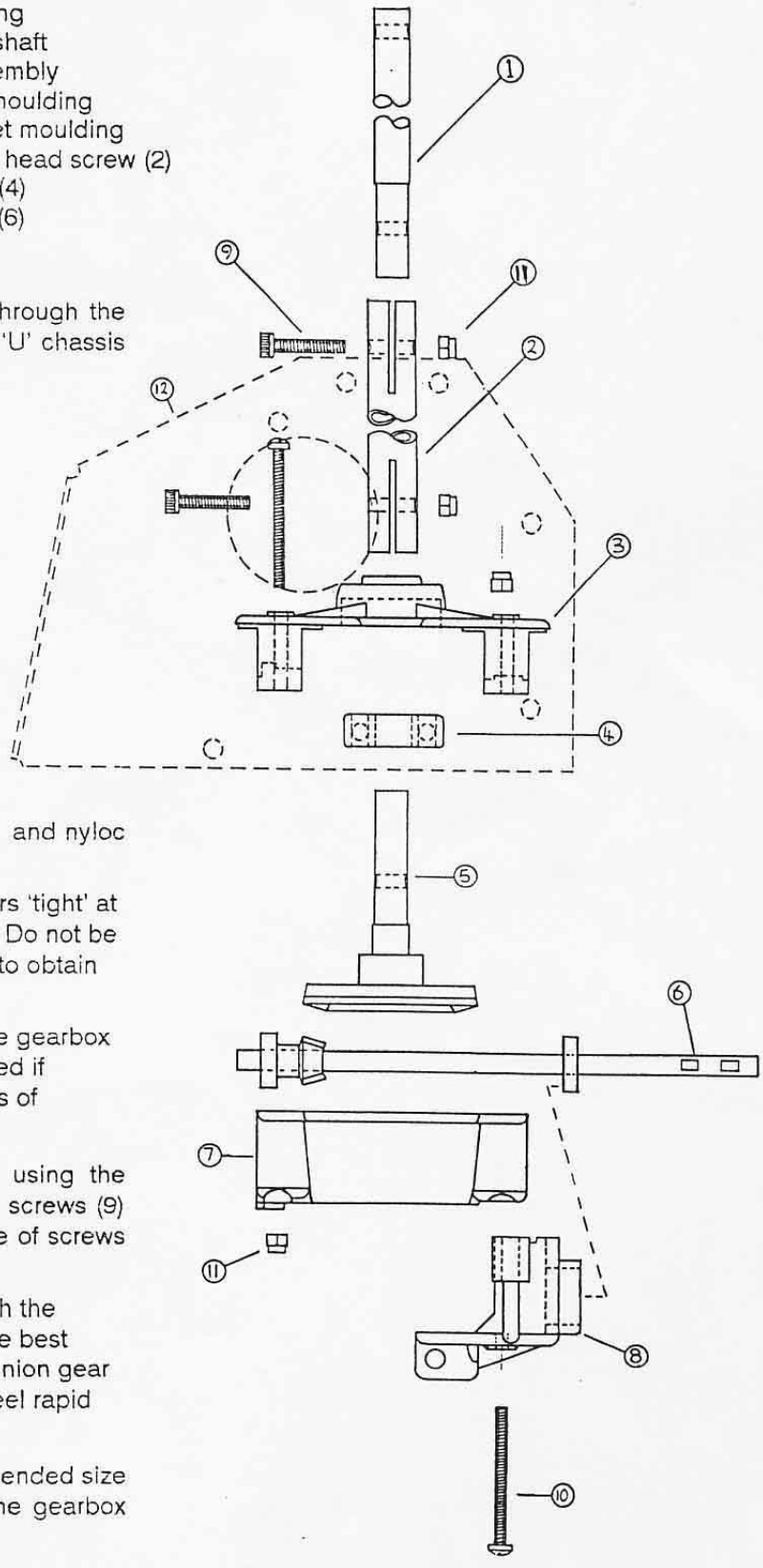
The tailrotor gearbox and hub is now pre-assembled for you, leaving only the blades and control yoke and crank to be fitted. The full assembly insructions have been left in for any future reference.

Ref. pages 2 & 17.

The grease for the gearbox and hex. couplings is now supplied and is packed with the gearbox components.

MAIN GEARBOX

STOCK CODE	Diagram Key	
0MG/MAST	1	Rotor mast
0MG/CPL	2	mast coupling
0MG/C1	3	gearbox top moulding
0MG/BB	4	8mm ball-bearing
0MG/CWS	5	crownwheel & shaft
0MG/ISAS	6	input shaft assembly
0MG/C2	7	gearbox case moulding
0MG/BRKT	8	gearbox bracket moulding
M3X16SC	9	M3 x 16 socket head screw (2)
M3X30	10	M3 x 30 screw (4)
M3NLN	11	M3 Nyloc nuts (6)
479CH/BASE	12	chassis



With the crownwheel shaft (5) upwards through the centre of the three adjacent holes in the 'U' chassis (12), slide the 8mm ball bearing (4) down on the shaft until it is touching the gear. Make sure the (larger) recess in the top moulding (3), for the input shaft ballrace, is at the front (towards the chassis flanges). Slide the top moulding down the shaft, over the ballrace, and through the chassis.

Pack the gearbox (7) with light grease (ie fill the base).

Place the input shaft (6) into position in mesh with the main gear, and with the lower gearbox case and gearbox bracket (8) over it. Pull the gearbox together with the four M3 x 30 screws (10) and nyloc nuts (11). Tighten fully.

☞ Do not worry if the gearbox appears 'tight' at first as it will soon bed in with use. Do not be tempted to slacken off the screws to obtain free rotation.

Once your model is operational the gearbox should be checked and re-tightened if necessary after approx. 30 minutes of running.

Assemble the mast (1) to the gearbox using the coupling (2) with two M3 x 16 socket cap screws (9) and nyloc nuts. Do not use any other type of screws or nuts for this assembly.

☞ Note: In the event of a severe crash the gears could be damaged. They are best replaced as a pair. E.g. if a new pinion gear is used with a damaged crownwheel rapid wear will occur on the new gear).

If using an engine larger than the recommended size (.40 cu in) you risk increased wear on the gearbox and it should be checked more frequently.

ENGINE MOUNT

STOCK CODE	Diagram Key	
0MR/FAN	1	cooling fan
0MR/FLY	2	flywheel
0MR/P16T	3	16 tooth drive pulley
0MR/SP	4	starter pulley
0MR/FD	5	fan duct
0MR/FDB	6	fan duct backplate
M3X16SC	7	M3 x 16 socket cap screw (4)
M3X10	8	M3 x 10 screw (2)
M3NLN	9	M3 nyloc nut (4)
M3N	10	M3 nut (2)
M3SW	11	M3 starwasher (2)
ST1	12	No 2 x 10mm self tappers (3)
479CH/EP	13	engine mount plate
ACC/SILH	14	horizontal muffler (optional)

Temporarily fit the flywheel (2) on the engine crankshaft making sure the flywheel inner face is seated properly on the engine prop driver.

Follow by the cooling fan (1), drive pulley (3) and engine nut, but note that these are not fitted finally until the engine unit is fixed to the mounting plate and the cooling duct is fitted.

The engine should be on the centre line of the cut out in the engine plate and placed so that the rear edge of the flywheel is 3mm (1/8") from the edge of the plate. Mark and drill for the four M3 x 16 socket cap screws (7) and fit the engine using M3 nyloc nuts (9).

Remove the fan and pulley from the engine. Fit a brass ball (from the controls pack) to the engine throttle lever using an M2 x 12 screw and M2 nut.

The fan duct (5) is a universal item used on all Morley helicopters; it is however, best to modify it slightly for use on the Bell 47. This is done by cutting away the shaded area shown in the diagram, using a small hacksaw and trimming with a knife.

The fan duct must now be fixed to the backplate (6) using three No 2 self tapping screws (12) and cyano instant glue (eg Super Glue).

Place this unit in position over the front of the engine and replace the cooling fan.

Line up the fan duct so that it is level with and clears the cooling fan.

Mark and drill 3mm holes in the plastic mounting lugs and fix with M3 x 10 screws (8), starwashers and nuts.

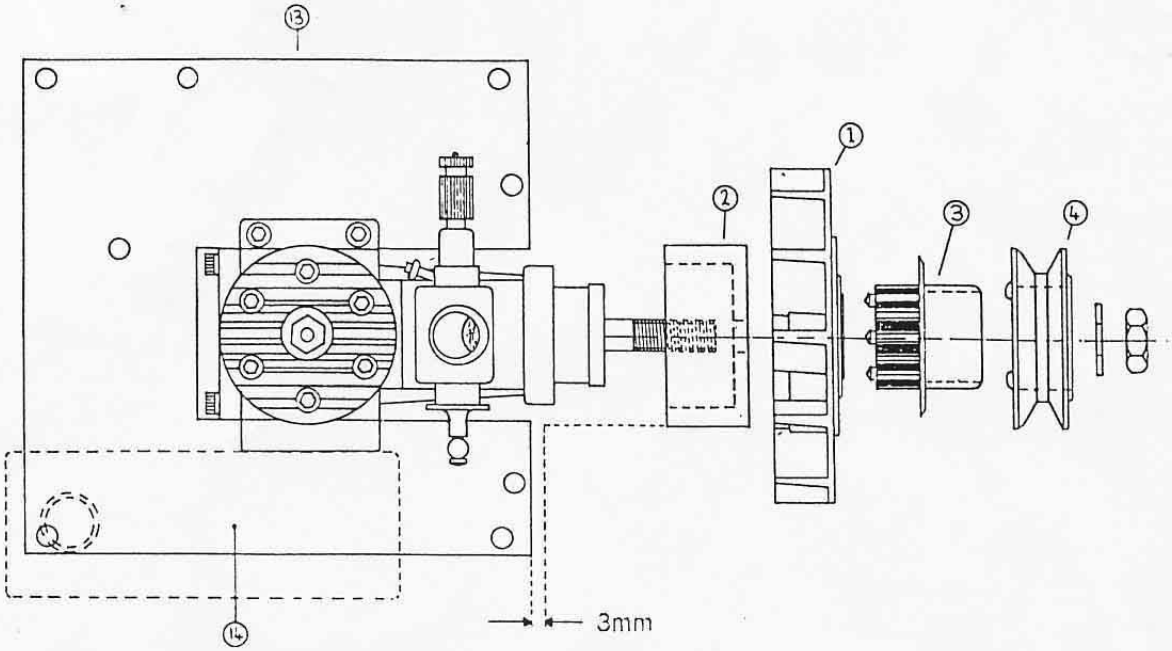
☞ The flywheel, fan and pulley must all be fixed with a locking compound between their surfaces in order to stop them undoing if the motor backfires on starting. Tighten the assembly now with the engine nut.

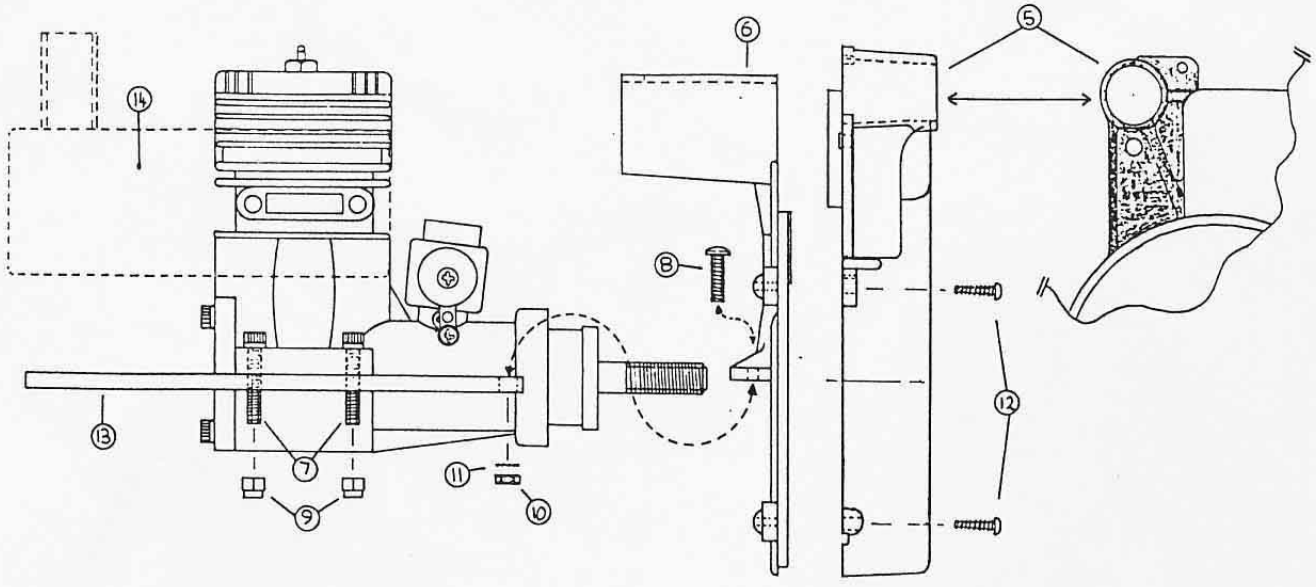
Fit the starter pulley (4) onto the drive pulley using either super glue or a slow cure epoxy.

Check the throttle arm does not foul the fan duct.

- Owners of Irvine .40 engines can return their flywheel to Morley Helicopters with £1 for a replacement flywheel with 10mm hole for the prop driver boss.

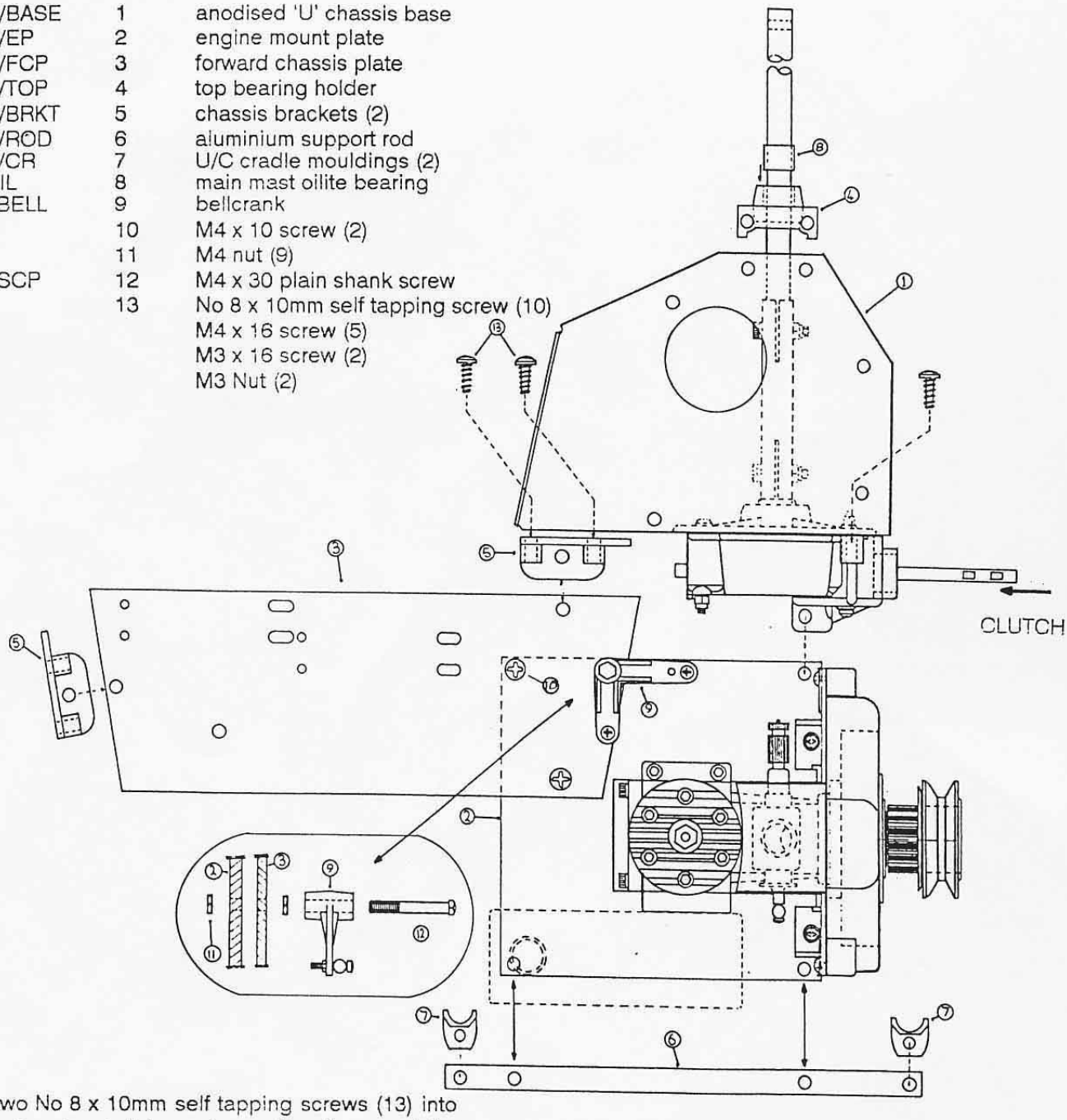
ENGINE MOUNT





CHASSIS

STOCK CODE	Diagram Key	
479CH/BASE	1	anodised 'U' chassis base
479CH/EP	2	engine mount plate
479CH/FCP	3	forward chassis plate
479CH/TOP	4	top bearing holder
479CH/BRKT	5	chassis brackets (2)
479UC/ROD	6	aluminium support rod
479UC/CR	7	U/C cradle mouldings (2)
0MG/OIL	8	main mast oilite bearing
0CON/BELL	9	bellcrank
M4X10	10	M4 x 10 screw (2)
M4N	11	M4 nut (9)
M4X30SCP	12	M4 x 30 plain shank screw
ST3	13	No 8 x 10mm self tapping screw (10)
M4X16		M4 x 16 screw (5)
M3X16		M3 x 16 screw (2)
M3N		M3 Nut (2)



Insert two No 8 x 10mm self tapping screws (13) into the gearbox bracket from above. Also fix one of the chassis brackets (5) under the 'U' chassis using four of the large self tappers.

Slide the top bearing holder (4) down the mast and fix in position with four M8 x 10mm self tapping screws. Slide the oilite bearing down the rotor mast and into the holder, and fix it in the plastic holder using a slow setting epoxy glue.

Fit a 90 degree straight arm bellcrank from the controls pack to the M4 x 30 plain shank screw, with some light grease on the shaft for smooth operation.

The forward chassis plate (3) is bolted to the completed engine plate using two M4 x 10 screws (10) and M4 nuts, and the M4 x 30 plain shank screw (12) with its bellcrank. This screw must be secured by an M4 nut on both sides of the assembly as shown on the inset diagram, so that the bellcrank is free to move.

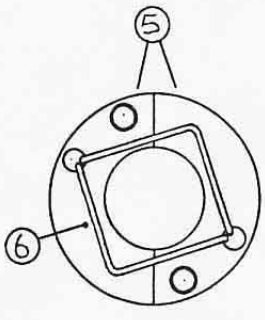
The undercarriage support rod (6) is fitted to the engine plate on the same side as the engine using two M4 x 16 screws and M4 nuts. The two undercarriage cradle mouldings (7) are fitted to the support rod using M3 x 16 screws and M3 nuts.

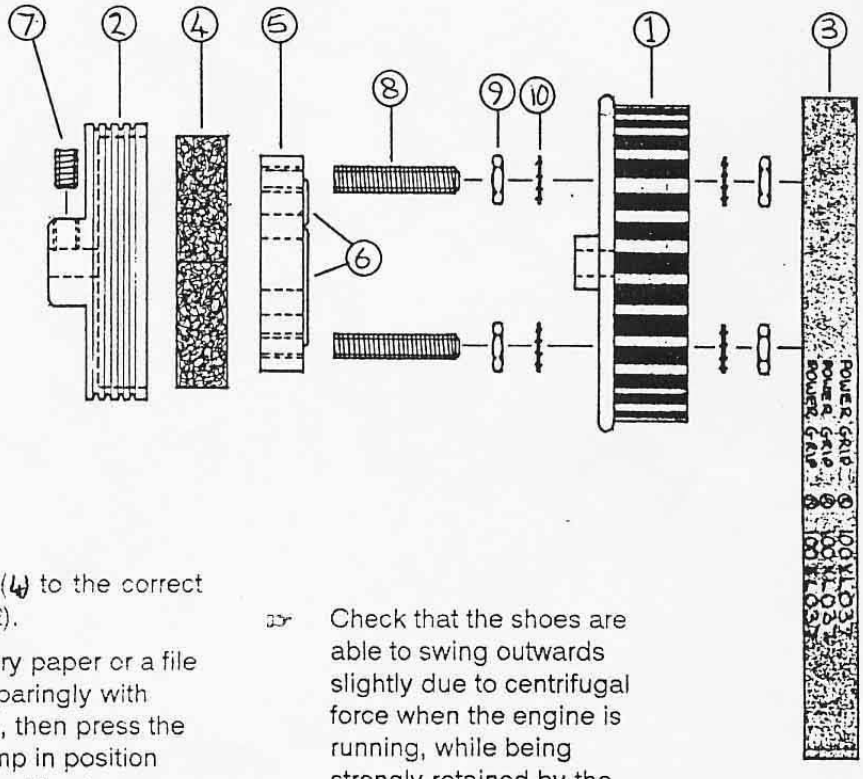
The completed 'U' chassis and gearbox assembly can now be lowered onto the engine and chassis plates and fixed in position with the gearbox bracket and chassis bracket using M4 x 16 screws and M4 nuts.

Finally the second chassis bracket (5) is fitted at the extreme front of the forward chassis plate using and M4 x 16 screw and M4 nut. This is used to support the radio battery pack at a later stage.

CLUTCH UNIT

STOCK CODE	Diagram key	
0CL/LP	1	large pulley
0CL/DRUM	2	clutch drum
0CL/XL100	3	100 XL 037 toothed drive belt
0CL/LINER	4	cork liner
OCL/SHOES	5	clutch shoe (2)
0CL/SPRING	6	clutch shoe spring (2)
M4X6SS	7	M4 x 6 socket set screw
M4X20SS	8	M4 x 20 socket set screw (2)
M4N	9	M4 thin nut (4)
M4SW	10	M4 star washer (4)
		Set screw key





Carefully cut the cork clutch lining (4) to the correct length to fit inside the clutch drum (2).

☞ Roughen the drum with emery paper or a file and cover it and the lining sparingly with slow setting epoxy adhesive, then press the lining tightly into place. Clamp in position with clothes pegs or similar until set.

Thread the M4 x 20 socket set screws (8) into the clutch shoes (5), with the key end of the screw just level with the surface of the shoe. Fit an M4 thin nut (9) at the rear, one turn clear of the shoe. Locate clutch springs (6) in clutch shoes and add star washers (10) onto screws.

Place the assembly into the large pulley (1) as shown in diagram and secure with star washers and thin nuts. Adhesive tape across the shoes is a help while doing this.

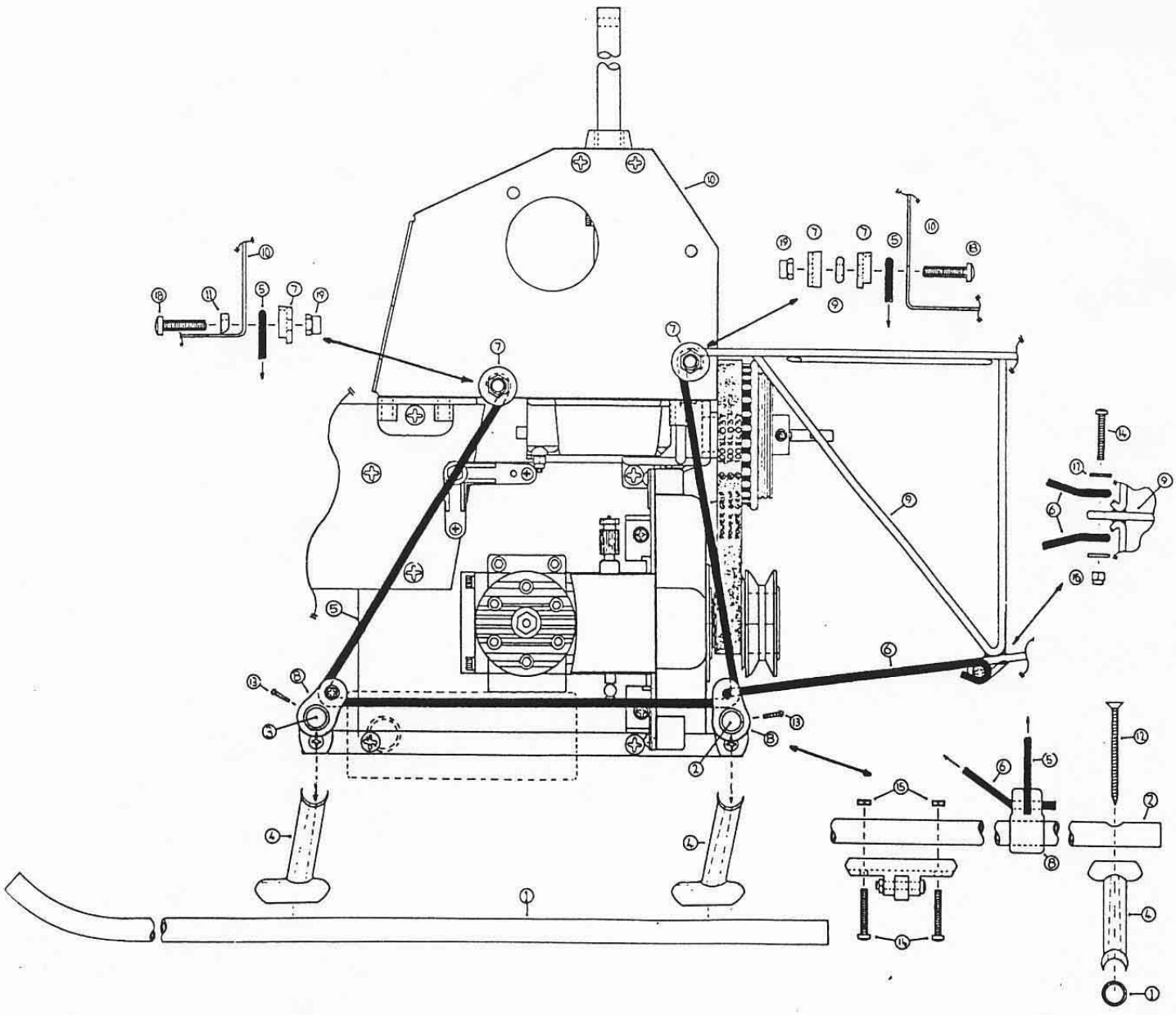
☞ Check that the shoes are able to swing outwards slightly due to centrifugal force when the engine is running, while being strongly retained by the springs when stationary.

Fit the toothed drive belt round the engine pulley and slide the clutch assembly onto the gearbox input shaft, followed by clutch drum. Align large and small pulleys, using spacer washers if needed (not supplied) and tighten clutch drum grubscrew (7).

Excess length of the M4 x 20 screws may be removed with a small hacksaw if desired. Hold the screw against rotation while this is done, by fitting the Allen key into the slot.

UNDERCARRIAGE AND TAIL BOOM FIXING

STOCK CODE	Diagram key	
479UC/SKDS	1	aluminium skids (2)
479UC/CTS	2	crosstube (short)
479UC/CTL	3	crosstube (long)
479UC/LEG	4	leg moulding (4)
479UC/SS	5	side stay wire (2)
479UC/BS	6	boom support wire
479UC/BH	7	wire end cap (6)
479UC/BH	8	U/C and boom holder (4)
479TB/BOOM	9	enamelled tail boom structure
479CH/BASE	10	'U' chassis
	11	moulded wedge (2)
ST2	12	1.5" self tapping screw (4)
ST1	13	No 2 x 10mm self tapping screw (4)
M3X16	14	M3 x 16 screw (7)
M3N	15	M3 nut (6)
M3NLN	16	M3 nyloc nut
M3W	17	M3 flat washer
M4X16	18	M4 x 16 screw (4)
M4NLN	19	M4 nyloc nut (4)



UNDERCARRIAGE AND TAIL BOOM FIXING

Fasten the side stay wires (5) to the 'U' chassis (10) at their front and rear mounting points. On the front mounting point use the small moulded wedges (11) under the M4 x 16 screw head (18) in order to seat the screw properly.

The wire is secured by passing the loop on the end of the wire over the screw thread then placing a black plastic cap over it, finally fixing with an M4 nyloc nut (19). (Diagram A)

The rear mounts do not use any plastic wedges. The screw passes though the chassis side, with the loop of the stay wire over the screw followed by a plastic end cap, then the loops on the end of the tailboom itself fastened with a further plastic cap and an M4 nyloc nut. Diagram B shows this assembly when viewed from the rear.

The next stage is to fit the undercarriage and boom holder mouldings (8) onto the corner bends in the side stay wires (5). The front two are retained by M3 x 16 screws and M3 nuts, and the rear two are held by the boom support wire (6) - this, however, must first be cut in two at its centre.

Push the long crosstube (3) through the front pair of holders (8) and the shorter crosstube (2) through the rear pair. The pre-drilled holes midway along the crosstubes should be positioned over the undercarriage cradle mouldings which were fitted earlier. The large holes at each end of the tubes must be facing upwards.

The crosstubes are then pulled down into the cradles using two M3 x 16 screws (14) and M3 nuts (15). Do not strain the assembly. If necessary, put packing *under* the tubes before tightening. This stage of the assembly is shown in diagram C.

The third tailboom mounting can now be secured by clamping the two rear support wires on either side of the lower wire loop on the tailboom. It is important to use flat M3 washers (17) each side of the wires, under the nyloc nut and the head of the bolt. Diagram D shows this joint.

Insert a 1.5" self tapping screw (12) through each of the crosstube end holes and through a leg moulding (4). The aluminium skids (1) must be marked and drilled to 3mm to accept the screws. Before final tightening down, apply slow epoxy glue to the metal and plastic faces.

The tail boom can now be finally aligned. The top rails of the boom should be horizontal. If not, then move the side stays in the moulded holders, in or out along the crosstubes. Once the correct positions have been found the mouldings are fixed to the crosstubes by drilling 2mm holes through into the metal and inserting No 2 x 10mm self tapping screws (13).

The two remaining mouldings in the undercarriage pack are fuel tank retaining clips. These snap onto the side stay wire opposite the motor. The fuel tank, fitted later, is held by two light rubber bands over the tank and retaining clips.

A suitable universal engine muffler is available as an option, part no ACC/SILH.

CONTROLS

STOCK CODE	Diagram key	
479CH/BASE	1	'U' chassis
479CH/FCP	2	forward chassis plate
479CH/EM	3	engine plate
0CON/CA	4	collective cradle arm (2)
0CON/BELL	5	bellcrank (straight arm) (2)
0CON/BELL	6	bellcrank (cranked arm) (2)
0CON/EYE	7	actuating eye (2)
0CON/SP	8	bellcrank spacer (2)
0CON/SMNT	9	single servo mount bracket (4)
0CON/SH100	10	bellcrank pivot 100mm
ACC/BJ	11	moulded ball eye (20)
M2X12	12	M2 x 12 screw (16)
M2N	13	M2 nut (16)
ACC/BJ	14	brass control balls (17)
ST1	15	No 2 x 10mm self tapping screw (8)
M4X16	16	M4 x 16 screw (2)
M4N	17	M4 nut (4)
M4SW	18	M4 starwasher (4)
0CON/ROD37	19	control rod 37mm (3)
0CON/ROD50	20	threaded stud 50mm
0CON/ROD65	21	control rod 65mm (2)
0CON/ROD135	22	control rod 135mm (5)
	23-28	radio equipment

Fit all the brass control balls (14) with M2 x 12 screws (12) and M2 nuts to the three bellcranks (5 & 6) as shown in diagram A. It is recommended that all these threads are locked with compound or paint to ensure they stay firm against engine vibration.

Thread a 65mm control rod (21) into an actuating eye (7) then thread a moulded ball eye (11) onto the other end. Lightly grease the 100mm pivot shaft (10) and slide on a cranked bellcrank (6) followed by the actuating eye and rod which has just been assembled. Next fit another cranked bellcrank, then a small spacer (8), a straight arm bellcrank and a second spacer (8). Diagram A.

Place this assembly into the 'U' chassis and push a cradle arm (4) onto each end of the pivot shaft. (Note the cradle arms are not left and right handed). Use M4 x 16 screws (16) to pivot the cradle assembly using light grease to ensure smooth operation.

Lock the pivot screws with M4 starwashers (18) and M4 nuts (17) on each side of the chassis plate.

The whole bellcrank and cradle assembly must be able to pivot up and down on its mounting screws in order to provide collective pitch.

Lock the cradle arms onto the shaft by carefully tightening the set screws moulded into the ends of the arms.

Pass the 65mm control rod down through the hole in the base of the 'U' chassis and connect to the longer arm of the bellcrank which pivots on the chassis (5). Adjust the length of the link so that the cradle arms and bellcrank are parallel, as shown in Diagram C.

The servo mounting brackets (9) are fitted to the forward chassis plate (2) using No 2 x 10mm self tapping screws (15). The radio servos are fitted to the mounts using the screws supplied with the radio system. Always use rubber grommets when fitting servos as these protect against harmful engine vibration.

The plywood cabin rear bulkhead (29) must be fitted before any servos and pushrods are connected to the bellcranks. Remove the die-cut sections in the centre, apply paint and fuel proofer, and fit using two M4 x 10 screws and nuts.

Installation diagrams for throttle and collective are provided for both four servo (Diagram D) and five servo (Diagram E) set-ups, ie for standard or helicopter radio systems.

The two cyclic control servos (23) & (24) are mounted on the front two mounts. The tailrotor servo (25) fits on the rear mount to the right, and the collective/throttle servo or servos (26) & (27) on the remaining mount. Note that the throttle/collective servos are inverted on the bracket.

The pushrod connections (21,22) are shown clearly in diagrams B and C. *Note that the positions shown are with the servos at neutral.*

The bellcrank-to-swashplate connections shown in Diagram C are made with 37mm rods (19) and balleyes and should all be the same overall tip to tip length (approx 65mm). The front rod must be fitted with a brass control ball held up against the ball eye with an 8ba nut (slightly larger than M2 nut) on the threaded section.

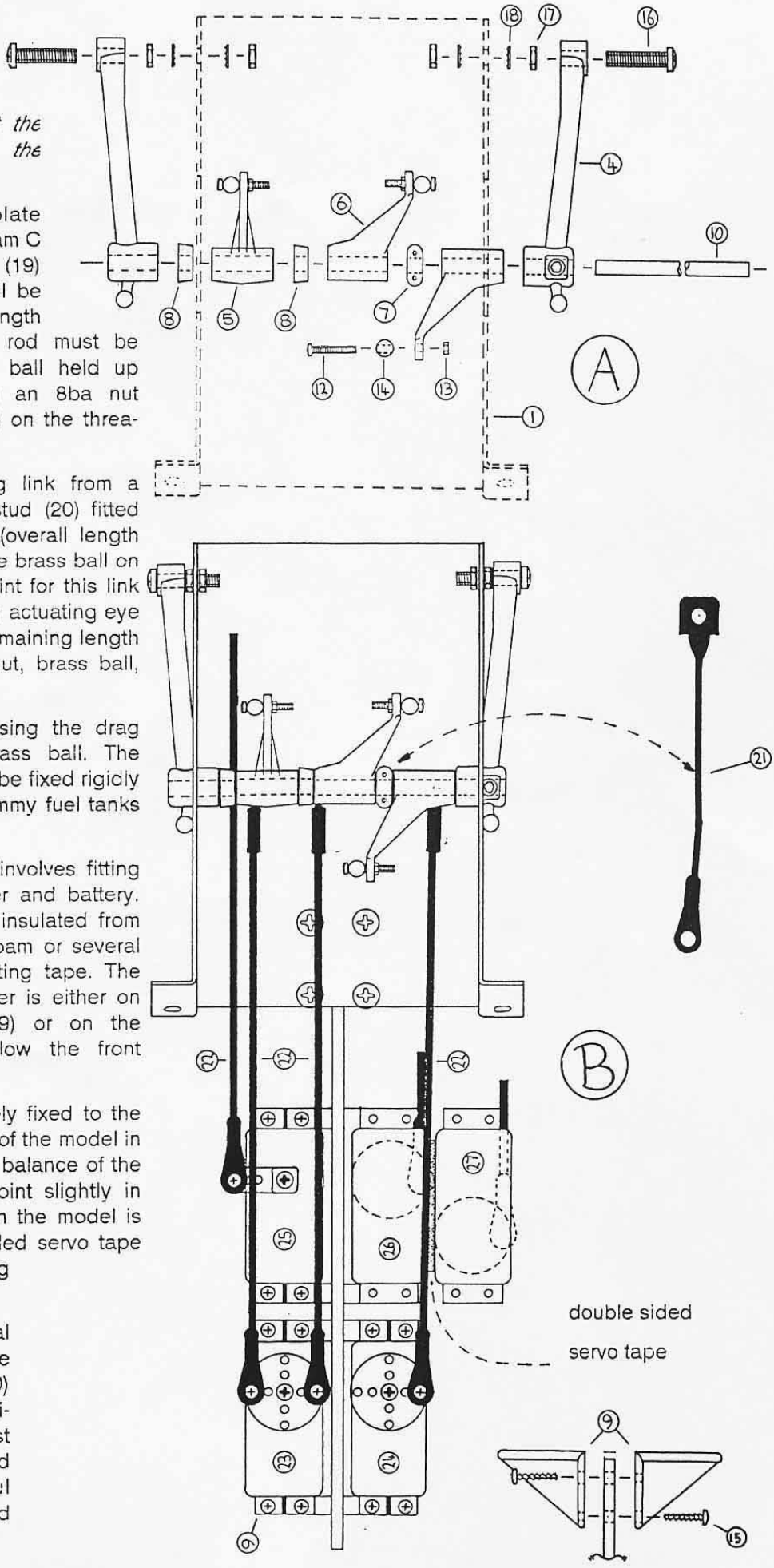
Make the swashplate drag link from a 25mm length of threaded stud (20) fitted with a ball eye each end (overall length 45mm) then pressed over the brass ball on the front rod. An anchor point for this link is made using the remaining actuating eye (7 in Diagram C), with the remaining length of threaded stud, an 8ba nut, brass ball, and another 8ba nut.

Complete the link by pressing the drag link ball eye over the brass ball. The actuating eye moulding will be fixed rigidly to the chassis when the dummy fuel tanks are fitted later.

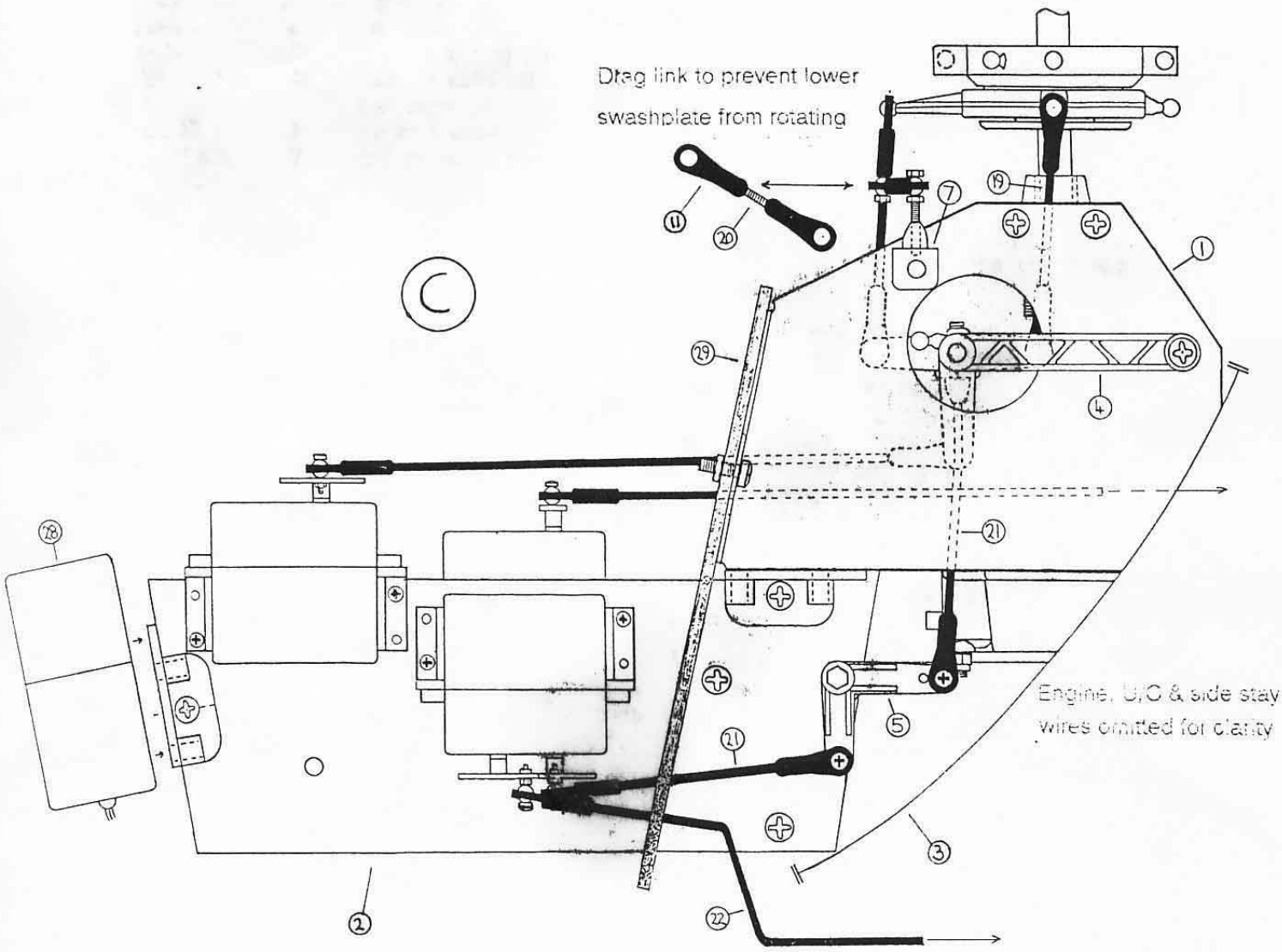
The final radio installation involves fitting and connecting the receiver and battery. The receiver must be well insulated from vibration by using rubber foam or several layers of thick servo mounting tape. The best position for the receiver is either on the plywood bulkhead (29) or on the forward chassis plate below the front servos.

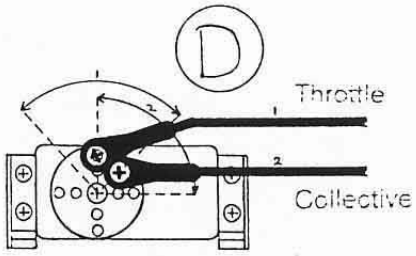
The battery must be securely fixed to the bracket at the extreme front of the model in order to achieve the correct balance of the whole machine (balance point slightly in front of the main mast when the model is completed). Use double sided servo tape and a tie wrap, or strong elastic bands.

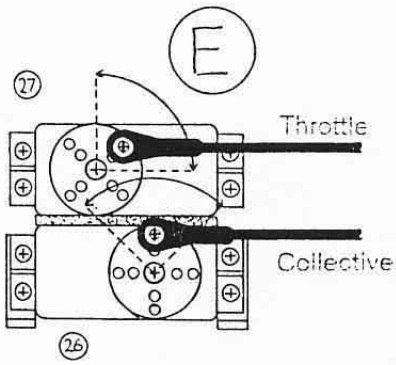
A gyro if fitted (optional equipment, order code GYRO/FPA or GYRO/GOLD) must be mounted on a horizontal platform which is best fixed firmly to the plywood bulkhead.Another useful option is the low battery and fuel indicator (3 On 1).



CONTROLS


Drag link to prevent lower swashplate from rotating
C
Engine, U/C & side stay wires omitted for clarity

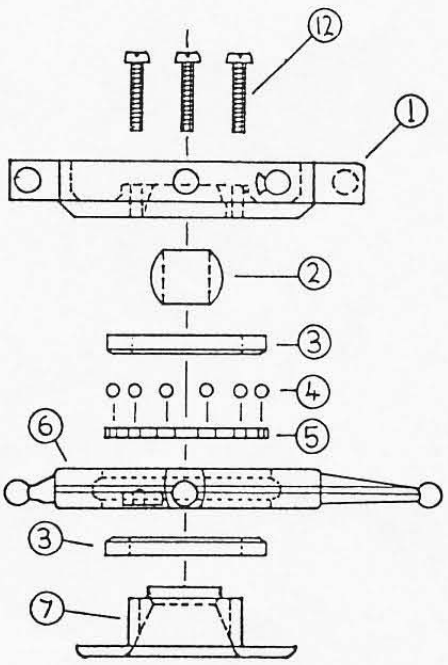

D
Throttle
Collective


E
Throttle
Collective

SWASHPLATE

STOCK CODE	Diagram key	
0SP/TOP	1	top moulding
0SP/BALL	2	centre ball
0SP/RING	3	small alloy ring (2)
0SP/BRG	4	bearing balls (12)
0SP/CAGE	5	ball cage
0SP/CENTRE	6	centre plate
0SP/BOTTOM	7	bottom moulding
M2X12	12	fixing screws M2 x 12 (6)

Any flash on the mouldings should be removed with a sharp knife.



Wipe all the alloy parts clean to ensure smooth running. Fill the groove in the centre plate (6) with a light grease then place on a flat clean surface.

Insert one of the two small alloy rings (3) into the centre plate ensuring that the chamfered side is uppermost.

Next insert the grey plastic ball cage (5), and using tweezers insert each of the 12 bearing balls (4) into the ball cage. It may be necessary to lift the centre plate slightly the let the balls seat in the centre groove. Once this is done the second of the small alloy rings can be inserted, this time with the chamfer facing down.

Insert the bottom moulding (7) into the centre plate from the underside then place the large plastic centre ball (2) with some grease in the seat on the bottom moulding.

The top moulding can then be placed over the ball and the whole assembly secured together with 4 M2 x 12mm screws (12). It is important not to overtighten these screws - however, there should be no free play in the bearing, so careful fitting is required.

Any future wear in the bearing can be taken up by re-tightening the four fixing screws.

Slide the completed swash plate on the rotor mast with the long arm to the rear (except Bell 47 when the long arm goes to the front).

☞ Swashplate rocking movement must be free and the assembly should slide easily up and down the rotor mast. Slide the swashplate driver over the mast before fitting the rotor head but do not clamp tight until later when the correct position has been found.

CABIN

STOCK CODE	Diagram key	
479CAB/GRP	1	one piece GRPcowl
479CAB/SHT	2	clear plastic canopy and tank mouldings
479CAB/PLY	3	all plywood cabin parts
ST3	4	No 8 x 3/8" self tapping screw (2)
M4X30	5	M4 x 30mm screw (2)
M4X10	-	M4 x 10mm screw (2)
M4N	-	M4 nut (6)
M4SW	-	M4 star washer (4)

The cabin is best assembled in using a good quality impact adhesive such as Loctite clear glue or Bostik No 1.

Cut out all the components using good sharp scissors to cut near the desired line but leaving some surplus to be trimmed away as assembly progresses, to give an accurate fit. Avoid trying to cut the material when it is cold as it could crack or split.

Glue the plywood floor (2) to the cabin underside (1). Mark a line 3mm from the rear edge of the plywood floor and then glue the doubler panels (3 & 4) along the sides and up to the marked line.

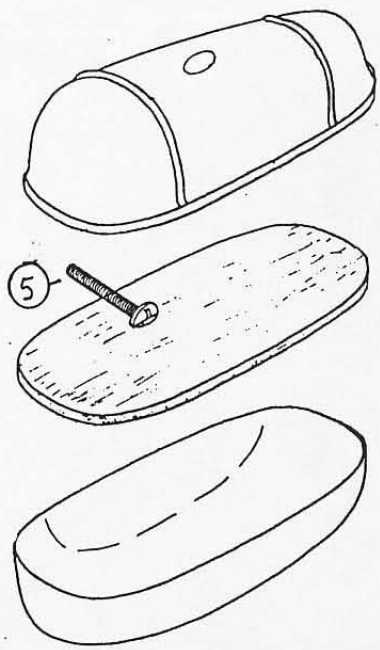
Carefully trim the canopy bowl (9) to fit then fix into position with glue, taking care not to smear glue over the remaining clear surface as this can spoil the looks of the model. The side doors can be left off for scale purposes or just to aid accessibility to the radio compartment. They do, however, make the whole canopy more rigid if glued into place.

The dummy fuel tanks are fixed to the chassis by M4 x 30mm screws (5). These must be fixed to the plywood formers with an epoxy glue with approx 12mm of thread left exposed. Note that the tanks are left and right handed. Glue the base of the tank to the ply former then carefully trim a straight edge around the top half leaving a recess for the screw thread before gluing in postion.

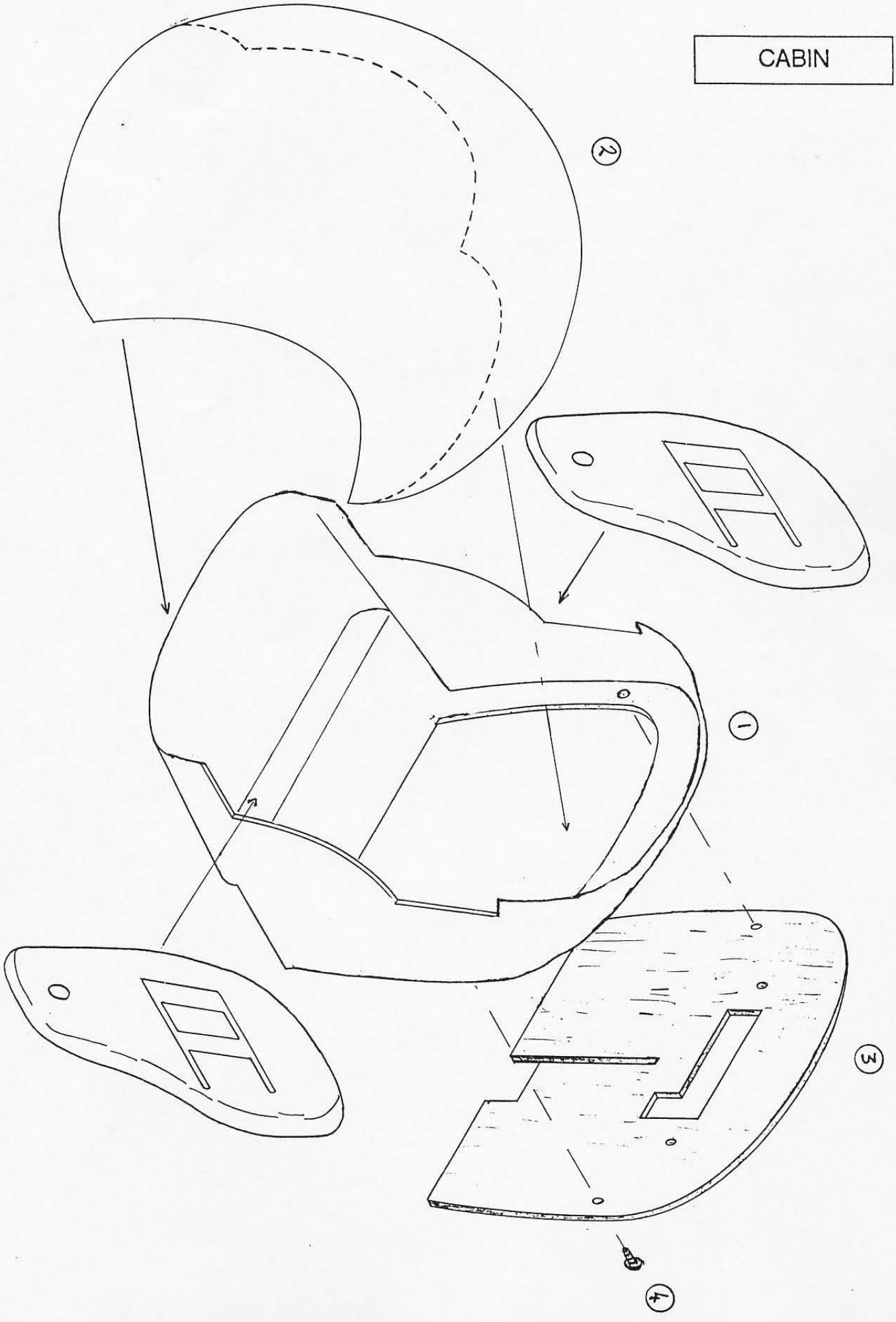
Parts of the cabin and tanks which are to be painted should be rubbed down lightly with a fine grade abrasive paper. The glass fibre will accept most types of paint when used with the appropriate base primer. Most paints are not fuel proof so unless you use a special paint a final coating with fuel proofer must be applied.

The canopy is fixed to the plywood bulkhead (3) by No8 x 3/8" self tapping screws (4). The plywood can be reinforced in the area of the screws with adhesive.

The swash plate drag link assembled earlier is held in position by the screw on the left hand dummy fuel tank, using M4 nuts and starwashers. Fit the right hand tank as shown.

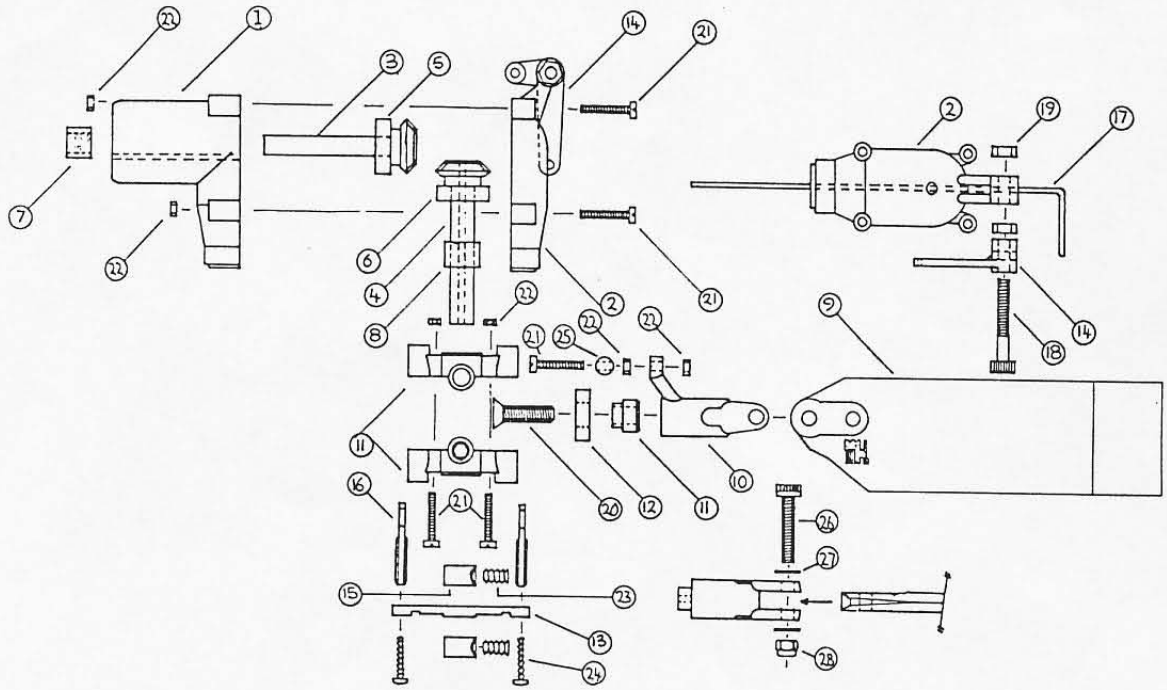


CABIN



TAIL ROTOR

STOCK CODE	Diagram Key	
0TR/C1	1	gearcase moulding
0TR/C2	2	gearcase back moulding
0TR/GIN	3	input mitre gear and shaft
0TR/GOUT	4	output mitre gear and shaft
0TR/BB1	5	3/16" ballrace
0TR/BB2	6	6mm ballrace
0TR/OIL1	7	3/16" oilite bearing
0TR/OIL2	8	6mm oilite bearing
0TR/BL	9	blade (2)
0TR/BM	10	blade mount (2)
0TR/HUB	11	1/2 hub and spacer (2)
0TR/BB2	12	ballrace 6 mm (2)
OTR/YOKE	13	control yoke
0TR/CRANK	14	tailrotor bell crank
0TR/CLR	15	control rod collars (2)
ACC/BJ	16	eye end (2)
0TR/WIRE	17	pitch control wire
M3X20SC	18	M3 x 20 socket cap screw
M3N	19	M3 nuts (2)
0TR/CS	20	csk screws 2ba (2)
M2X12	21	M2 x 12 screws (10)
M2N	22	M2 nuts (14)
M4X6SS	23	M4 x6mm grub screw
ST1	24	2 x 3/8 self tap screws (2)
ACC/BJ	25	ball end ball (2)
M3x16SC	26	M3x16 socketcap screw (2)
M3FW	27	M3 flat washers (4)
M3NLN	28	M3 nyloc nuts (2)



Remove the oilite bush (7) and push the input shaft (3) into the case (1). Also place the output shaft (4) in position in case (1).

Important:- Fill the case with a good quality light grease and attach the back casing (2) using four M2x12 screws (21) and M2 nuts (22).

Push the oilite bush (7) along the input shaft (3) into the case (1), check for free rotation.

Place a countersunk screw (20) through one of the ballraces (12) followed by a moulded spacer (11), and with paint or locking compound, screw tightly into one of the blade mounts (10). ***Locking with paint or compound is essential.***

Fit a ball end (25) to the pitch control arm of the blade mount (10) using one M2x12 screw (21) and an M2 nut (22) on each side of the arm. Repeat with the second ballrace and mount.

Clamp the ballraces between the moulded hub halves (11) and draw together using two M2x12 screws (21) and M2 nuts (22), do not apply adesive.

File small flats on the output shaft (4) to seat the set screws (23), and fit the tailrotor hub to the output shaft (noting the outer surface of the hub is flush with the end of the shaft), do not overtighten the grub screws.

The wire pushrod (17) passes through the centre of the output shaft (4) and moves the pitch control yoke (13) which is positioned between the two collars (15).

A plastic balleye (16) is fitted to each end of the yoke (13) with a No2x3/8 self tapping screw (24). The bellcrank (14) pivots on a 3mm bolt (18) on the arm protruding from the case (2), again with M3 nuts (19) either side of the arm.

Slot the blades (9) into the mounts (10) making sure the leading edge is forward, and hold with M3x16 socket cap screws (26) M3 flat washers (27) and M3 nuts (28). Refer to diagram for correct installation.

The groove in case (1) is for the 18g controol wire.

TAILBOOM

STOCK CODE	Diagram Key	
479TB/BOOM	1	enamelled tail boom structure
479TB/SEAT	2	tail gearbox seat
479TB/DS	3	drive shaft supports (3)
479TB/CS	4	control rod supports (5)
ACC/HEX	5	Hex' ball drive coupling (2)
479TB/TG	6	tail rotor guard
479TB/FC	7	fin mounting clips (4)
479CAB/SHT	8	clear plastic fin
" " "	9	clear plastic end fins (2)
479CAB/PLY	10	plywood stabilizer
	11	tail rotor gearbox complete
479TB/CL	12	65mm wire clamp
	13	8ba nut (2)
M4X6SS	14	M4 x 6mm set screw (6)

Use a good quality slow epoxy glue to fit the tail gearbox seat (2) onto the two prongs at the extreme rear of the boom (1). Fix the alloy tail guard (6) into the centre hole in the gearbox seat using super glue or epoxy, then join the front end to the lower tailboom longeron by binding with fuse wire or similar and covering the joint with epoxy glue.

File a flat on the gearbox input shaft and fit one of the female hex drive couplings (5b) using an M4 x 6mm socket screw (14) to clamp in place.

* Note if the screw is over-tightened the thread may be damaged, and this item will need to be replaced.

The second female hex coupling should be fitted in a similar manner to the output shaft of the main gearbox, behind the clutch drum.

Push one of the male hex couplings (5a) over the 16g drive wire (the larger of the two wires supplied) bend over approx 3mm of the end to 90 degrees then pull the coupling back over the bend so it is seated well into the groove. Clamp in place with two M4 x 6mm set screws.

Cut the drive wire to length (595mm from bend to end). Feed the drive wire supports (3a,b,c) and one control support (4) (lower of the two holes) onto the wire and then thread the assembly into the tail boom from the engine end.

Push light grease into the hex drive socket at the main gearbox and settle the hex ball into the socket. Jig the drive supports into position with the drive wire and push the second hex drive ball onto the wire. Bend the wire as before and secure the hex ball with two M4 x 6 set screws.

Push some grease into the hex socket mounted on the tail gearbox (11), locate the hex ball in the socket, and fit the gearbox assembly to the seat using the 'U' shaped 65mm wire clamp (12) through the locating holes in the seat, and two 8ba nuts (13).

Adjust the tail drive to a smooth curve from main gearbox to tail. The drive supports can now be fixed in position using epoxy glue.

Thread the control wire guides onto the 18g control wire, and line them up on the tail boom top cross stays before epoxying them in position. Take care not to get glue on the control wire itself.

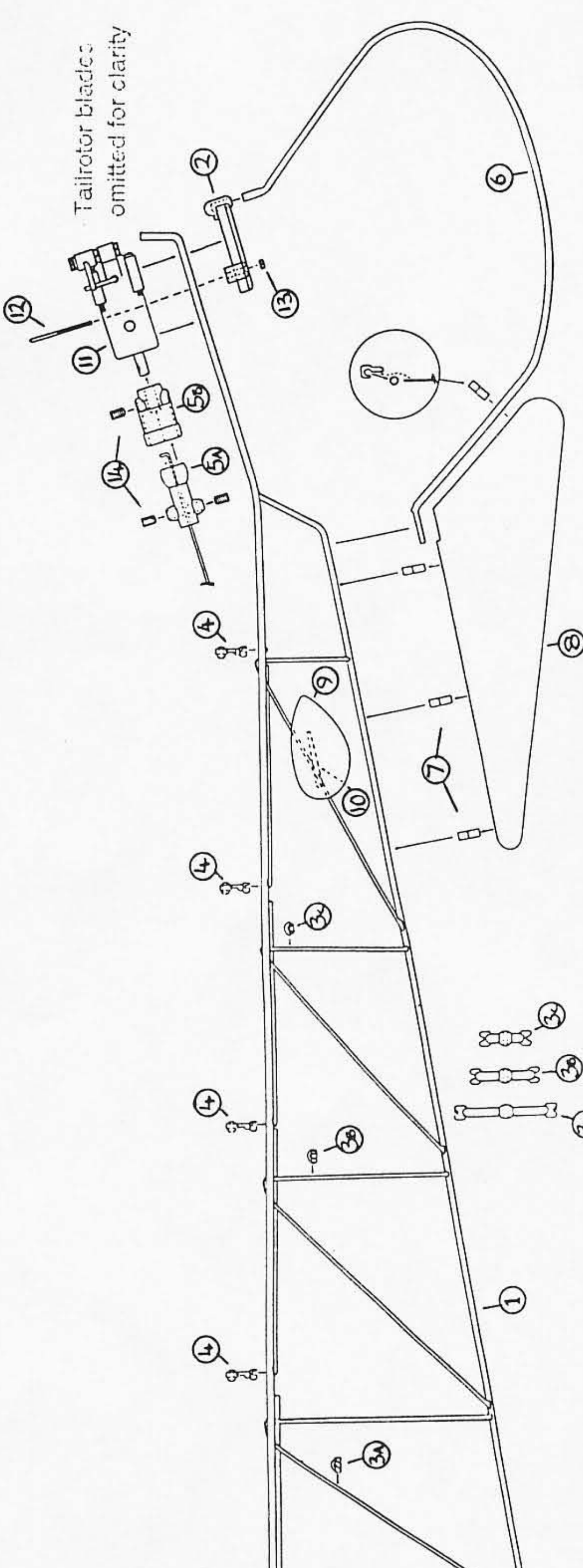
The end of the control wire must be formed upwards slightly at the rear end to clear the hex drive coupling and pass through the groove along the top of the gearbox, under the wire clamp, and finally bent 90 degrees up through the hole in the operating bellcrank. This control must be smooth so lubricate if necessary.

The control wire must be joined to the tail rotor servo pushrod - a small electrical connector block or similar is ideal for this.

The tail fin (8) cut from the transparent sheet is painted and then glued in position under the boom and tail guard as shown. Use the small mounting clips (7) to reinforce the joins.

Finally the horizontal stabilizer is sanded to shape from the plywood blank, fitted with its plastic end fins, painted, and epoxied to the tailboom (see more clearly on box lid label).

TAILBOOM


Tailrotor blades
omitted for clarity
1
2
3A
3B
3C
4
5A
5B
6
7
8
9
10
11
12
13
14

PACK 9

ROTORHEAD

STOCK CODE	Diagram Key	
ORH/PLATE	1	alloy head plate
ORH/BBM	2	blade & bearing mounts
ORH/TP	3	top plate moulding
ORH/MT	4	mast top moulding
ORH/RUBS	5	teeter rubbers
ORH/FBZZ	6	flybar zig-zag
ORH/FBOA	7	flybar operating arms
ORH/FB	8	flyblades
ORH/FBAR	9	flybar
ORH/BUT	10	head button
ORH/OIL	11	3mm oilite bearings
ORH/LINK	12	double ended links
ORH/BB	13	6mm ballraces
OSP/MIX/DRI	14	small mixer arms
" " "	15	large mixer arms
" " "	16	mixer slider fork

Fasteners from

M2	M3	M4
6xM2x12	6xM3x16 SC	2xM4x30 SC
6xM2 nuts	2xM3x20 PS	2xM4 NLN
4xbrass balls	2xM3x20 SC	
	4XM3x25 SC	
	4xM3x30 SC	
	12xM3 NLN	

Diagram A.

Before commencing assembly of the rotorhead ensure that the 'TOP' marking on the alloy headplate (1) is uppermost.

Lightly grease the bearings (13) then fit the bearing and blade mounts (2) over them, fitting the two M3x16 socket caps into the recesses. Insert two M3x25, two M3x30 socket cap screws and nyloc nuts, taking care not to overtighten them as this will cause binding on the bearings.

Clamp the incidence arm ends together with an M2x12 screw and nut as tightly as possible to prevent the M3x16 from moving. Thread on a small mixer arm (14) onto each of the protruding screws leaving them at least one full turn clear of the boss (these must be free to move).

Diagram B.

Bolt both mix/dri arms (15) to the slide fork (16) using M3x20 socket cap plain shank screws. Ensure correct orientation i.e:- fork faces up and arms pivot freely without slop.

Slip this assembly over the mast and connect the arms to the swashplate balls on the upper ring (refer to COMPLETED HEAD DIAGRAM).

Diagram C.

Sandwich the headplate between the mast top moulding (4),teeter rubbers (5) and top moulding (3), holding together with M3x16 socket cap screws and nyloc nuts. Make sure the nuts are pulled home and the rubbers are evenly and firmly clamped but not distored.

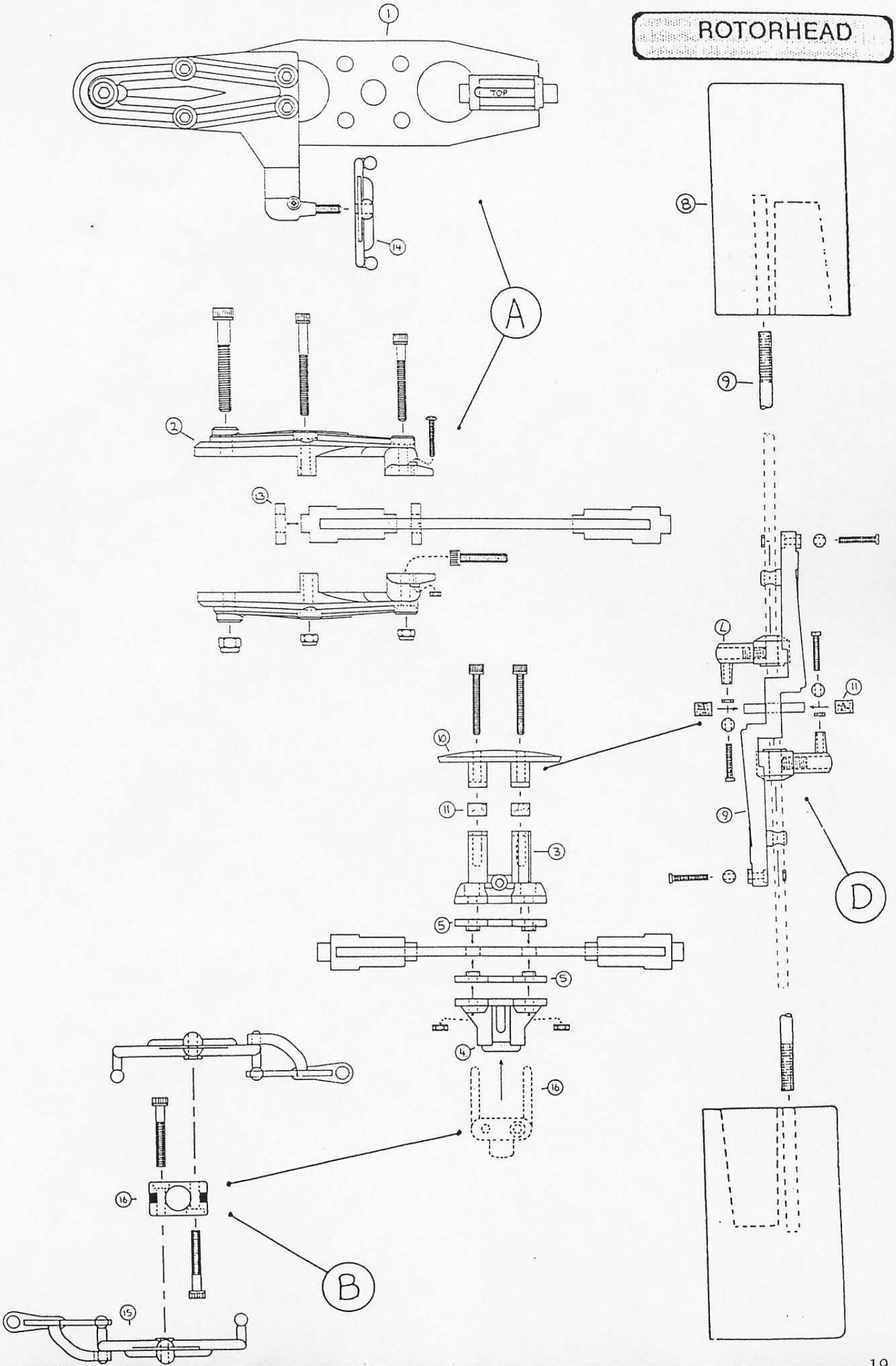
Fit the assembly on the mast and secure with a single M3x20 socket cap screw through the top moulding and the hole in the mast.

Diagram D.

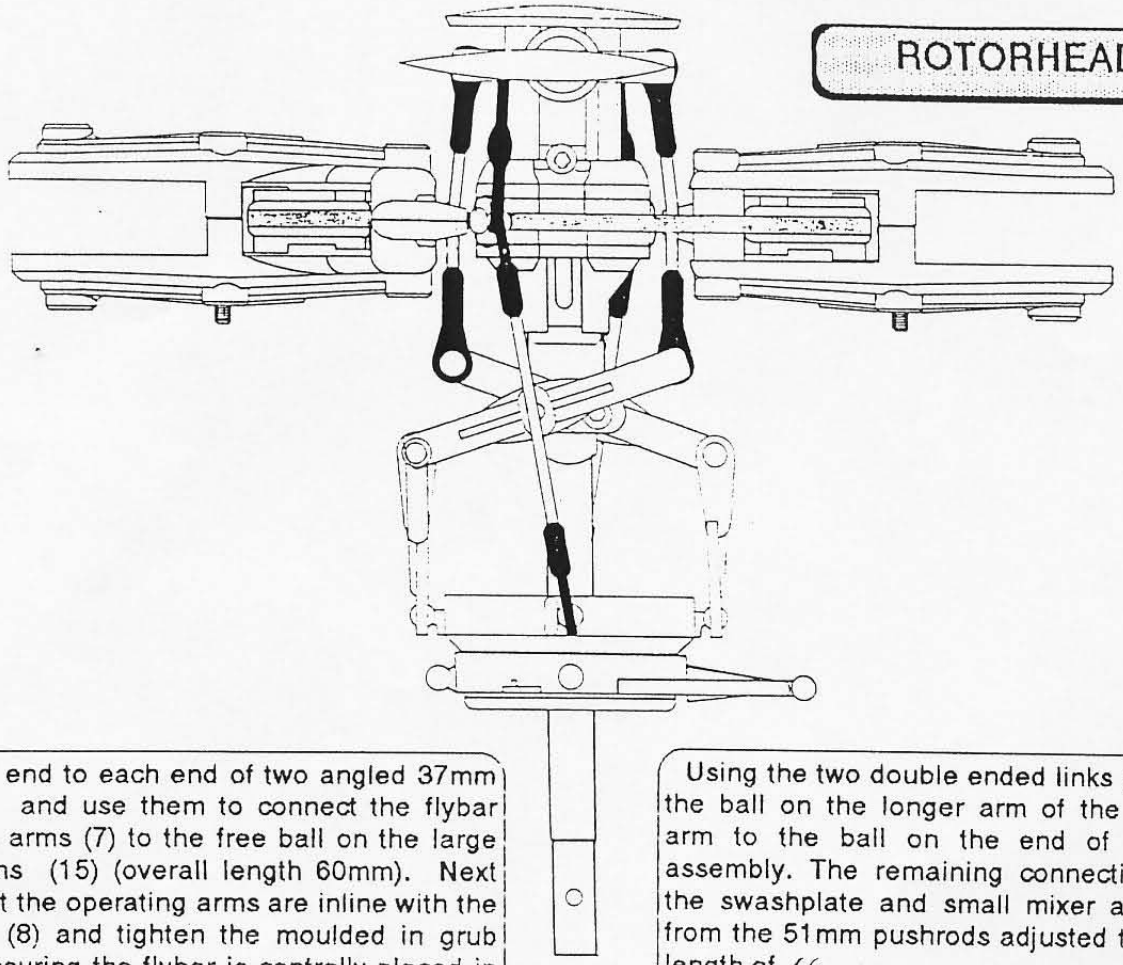
Fit a brass ball to each end of the zig-zag (6) using M2x12 screws and nuts, also to the stub on each flybar operating arm (7) (making sure the M2 nut goes under the brass ball). Pass the flybar (9) through the zig-zag threading on the flybar operating arms as shown. The flyblades (8) are fitted to the flybar by screwing them on to the threaded ends until they reach the end stops.

Slide the two oilite bearings (11) over the small central shaft moulded into the zig-zag then place on the pillars on the top moulding. Carefully position the head button (10) over the bearings and secure with two M3x20 socket caps (do not overtighten)

ROTORHEAD



ROTORHEAD



Fit a ball end to each end of two angled 37mm pushrods and use them to connect the flybar operating arms (7) to the free ball on the large mixer arms (15) (overall length 60mm). Next check that the operating arms are inline with the flyblades (8) and tighten the moulded in grub screw (ensuring the flybar is centrally placed in the zig-zag).

Using the two double ended links (12) connect the ball on the longer arm of the short mixer arm to the ball on the end of the zig-zag assembly. The remaining connection between the swashplate and small mixer arm is made from the 51mm pushrods adjusted to an overall length of 66mm.

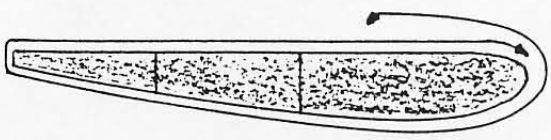
MAIN BLADES

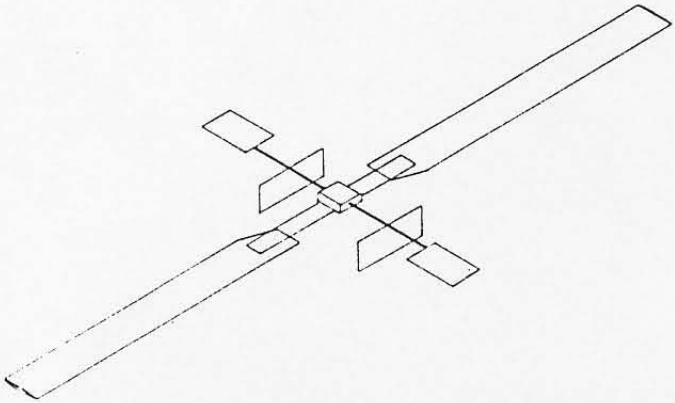
Covering.

First lightly sand the blades with a fine grade paper to a smooth finish, then paint the root and tip sections followed by covering the long parallel section with the fablon supplied as to the direction shown below. When completed press a brass bush into each of the 6mm holes in the blade roots, these act as blade pivot bearings. Fit the blades to the head using M4x30 socket cap screws and M4 nyloc nuts (the blades must by held firmly and evenly but should not pivot under thier own weight).

Balancing.

Place the completed rotor head and blade assembly across the jaws of a vice or two glass tumblers supported by the flybar as shown below. If the blades are level at rest then all is ok, however, if the one blade is higher then it must be weighted to bring it level with the other. The best way to do this is to cut a strip of vinyl tape (optional part ACC/GLOW) and place it on the blade tip and trim until balance is correct, then wrap around securly.





Assemble the fuel tank as in the diagram and fasten on the seating to the right of the engine with light rubber bands. These must not be tight or engine vibration will cause foaming of the fuel.

Check that the completed model balances just in front of the rotor mast. Turn the rotor until the main blade are along the length of the model. Lift the model by the fly bar. The nose should be slightly down with the skids almost horizontal.

Main Rotor

- Precise trim can vary widely according to many factors, including model weight, engine power, air temperature, humidity, height above sea level, type of fuel used, glowplug condition, engine condition, etc.
- However, a reliable starting point is to set the bottom surface of the main blades to O degrees with the engine throttle closed.
- Total vertical travel of the swashplate on the main mast should be 11-13mm while throttle moves to open.
- Main blade pitch during the hover is approximatly 3 to 4 degrees.

How it works:

The model will move in the direction of tilt of the main rotor disc, which follows the same tilt of the swashplate. This tilt is controlled by the two cyclic pitch servos.

Tilting the swashplate down at the front will result in the rotor disc also tilting down at the front, and the model dropping its nose and moving forward from the hover. The same goes for left, back, and right, and any other angle - the rotor follows the tilt of the swashplate and the model moves in that same direction.

☞ An anguiar movement of the swashplate of about 15 degrees in each direction (total 30 degrees) is sufficient for ample control without over-sensitivity.

Tail Rotor

A suitable setting for the tail rotor is for the flat surface of the blades to be at right angles to the pitch control rod (i.e. pitch is O degrees) when the transmitter control stick is pushed fully to the right (with Tx trim at neutral).

☞ It is most important that the control rods move freely.

Engine

☞ Have you got lubricant in the gearboxes? Occasionally lubricate the main gearbox with oil through the hole in well at rear of gear case. Grease is also essential in the hex couplings for the tail rotor drive.

Follow the correct running in procedure for your engine as given by the manufacturer.

- The carburettor must be set rich enough to keep the engine cool, yet lean enough to provide ample power. With the rotor collective pitch set as specified the engine should be set to a rich two stroke mixture.
- The rotor head should be held while starting the engine with the throttle just open. The centrifugal clutch may drag when new but will quickly settle so it will be free at a correct idle speed. Open the throttle by pushing forward left hand stick if you have installed according to the drawing. This will speed up the rotor head and apply collective pitch.
- Rotor speed is important on any model helicopter and too great a deviation can cause aggravating problems.

At about half stick the rotor should be spinning fast and tracking correctly - that is each blade should be in the same path as the other. The coloured tips enable you to see this.

If tracking is incorrect throttle back the engine and wait for the rotor to stop, then increase pitch on the lower blade and reduce pitch on the higher blade. If in order, advance the throttle/collective to the point where the model is decidedly light.

Shaking

If there is a shake on the model, stop the rotor and add an extra band of covering material to one blade (15mm wide for minor shake, 50mm for vicious), try again, if worse put it on the other blade. The fly blades may also need dynamic balancing in this way.

When tracking and balance are sorted out the throttle/ collective may be advanced to the point of lift off.

☞ Too low a rotor speed will cause powerful oscillations of the whole model. Do not

mistake them for an unbalanced head. The answer is to reduce collective pitch by lengthening the push rods between the paddle arm and the rotor incidence arm.

☞ Incidentally, an excess of collective pitch can cause the clutch to slip and heat up, and the tail rotor will be unable to cope with torque because it is running too slowly. Also in this condition the engine is working very hard at low rpm of the cooling fan, *so this is a dangerous condition to stay with.*

- If the engine screams and the model shows a reluctance to lift off then more pitch is required relative to throttle.
- If it lifts off but is very twitchy and sensitive on the controls again increase pitch to slow the rotor down.

☞ Lift off is best at about 1/2 to 2/3 of full throttle stick movement. Main rotor should be turning at approx 1100 rpm, equivalent to 4500 at the tail rotor, although up to 1300 is fine.

- Oscillations can also occur with a two bladed rotor head if the teeter is reduced by excessive tightening of the four teeter bolts (Rotor Head assembly sketch B). Try to adjust so the rotor head plate is held *firmly* but not solidly between the rubbers.

Similarly with the tail rotor. If the model tends to revolve at the point of lift off increase or decrease the tail pitch setting by moving the collars on either side of the yoke.

The model is now ready to fly.

Assembly of fuel tank.