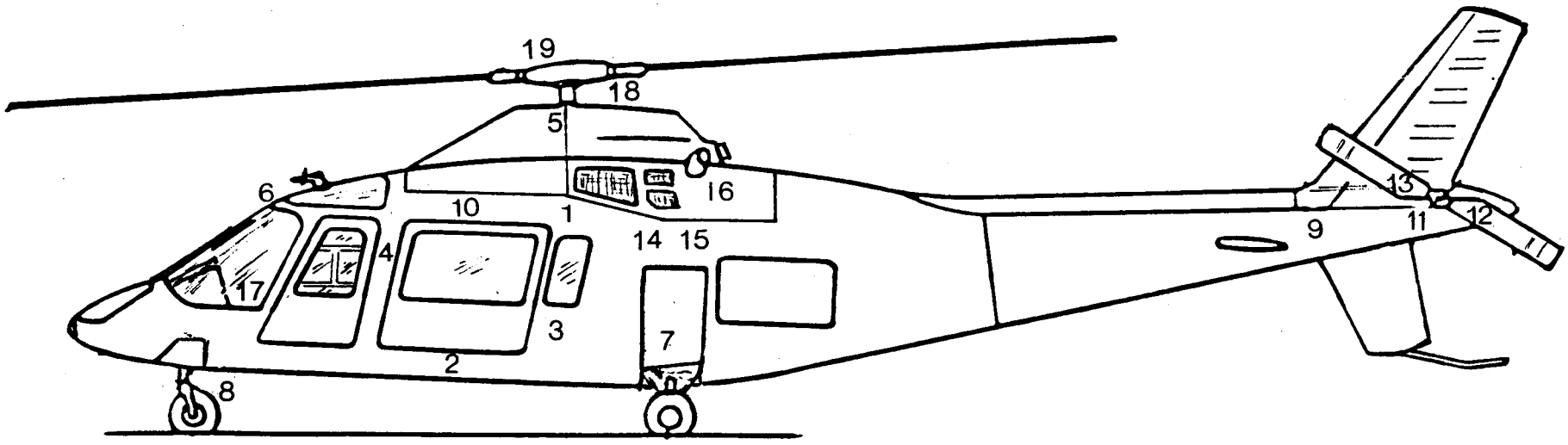
MORLEY
HELICOPTERS



AGUSTA 109

INSTRUCTIONS

Morley Mk 3

SPECIFICATION

Near 1/10 scale AGUSTA 109 model helicopter

Rotor	-	Morley 'AT' collective head 48" diameter (1220mm)
Main rotor speed	-	approx 1100 rpm
Engine	-	0.40 - 0.45 cu.in. 6.5-7.5 c.c.
Radio	-	4 - 5 channel proportional + retract channel
Fuel capacity	-	8 fl. oz (250 c.c.)
Flying weight	-	8 lbs (3.5 Kg) approx

Dear Customer,

Thank you for deciding to build this model. The Agusta 109 kit can be made into an exciting helicopter which will draw much admiration for its looks and performance.

It is important to follow the sequence of the instructions as, for example, the main retract gear has to be made into a unit and fitted before any other assembly is completed within the body.

Such a sophisticated model is presumably not being built by a beginner to radio-controlled helicopters, but a brief explanation of the control function is included and also a description of how to cope with their flying characteristics in order to make these instructions as universal as possible.

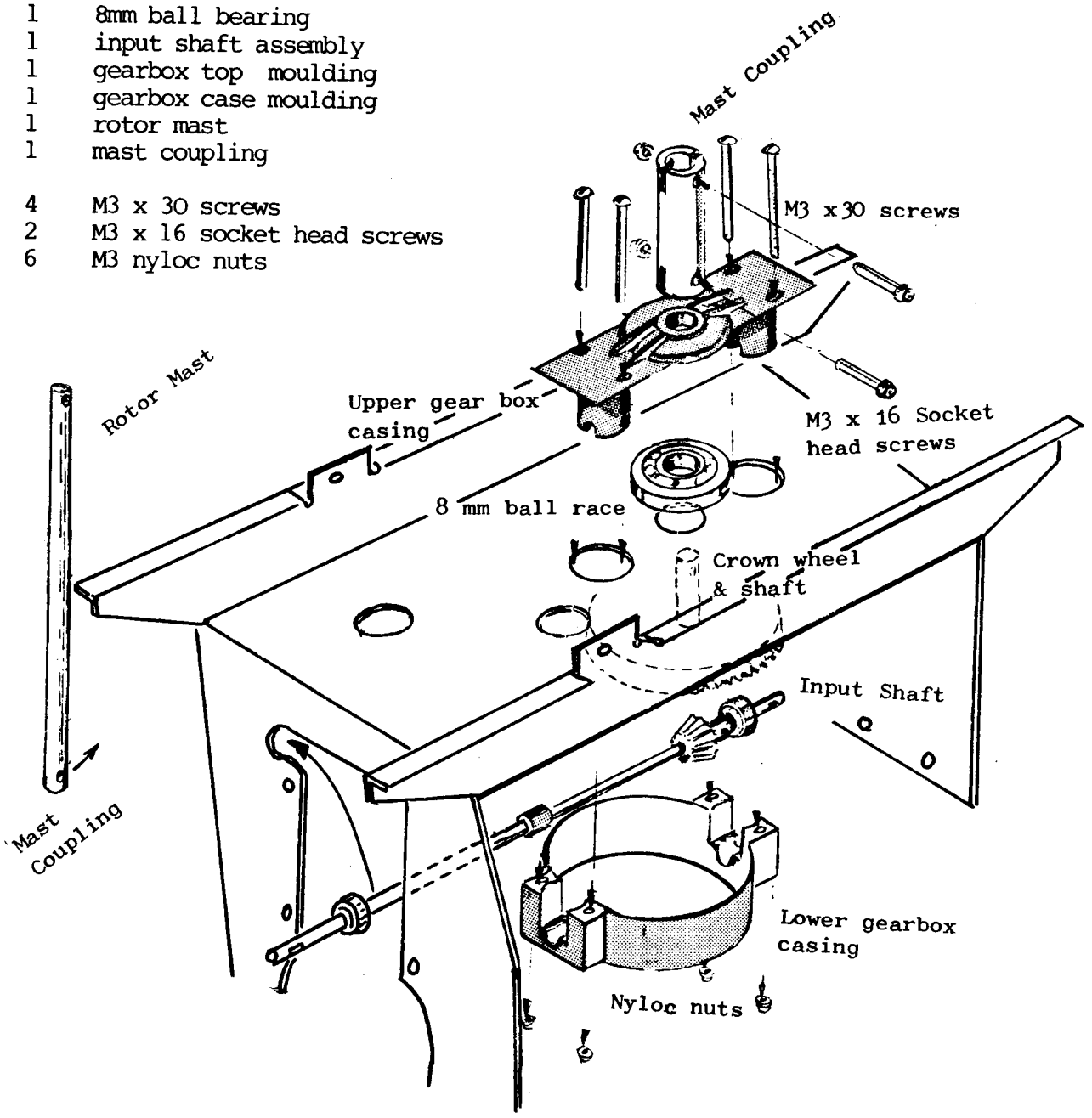
I hope you enjoy making a successful model.

Jim Morley

Diagram 1. Pack

1	crownwheel and shaft
1	8mm ball bearing
1	input shaft assembly
1	gearbox top moulding
1	gearbox case moulding
1	rotor mast
1	mast coupling
4	M3 x 30 screws
2	M3 x 16 socket head screws
6	M3 nyloc nuts

MAIN GEARBOX



With crownwheel shaft upwards through centre of the three adjacent holes in chassis, slide the 8mm ball bearing down the shaft until it is touching the gear. The gearbox top moulding is also slid down the shaft, over the ballrace, and through the chassis. Make sure the (larger) hole in the moulding for the input ballrace is at the rear. Cover the crownwheel with light grease.

Place the input shaft assembly into position and pull the lower gearbox case into position with four M3 x 30 screws and nyloc nuts. Tighten but ensure that rotation is reasonably free. It will loosen under load. There is a hole immediately above the pinion gear in the well of the top moulding for subsequent lubrication with gear oil.

Assemble the mast to the gearbox using the coupling with HT screws and nyloc nuts.

Diagram 2 pack

ENGINE MOUNT AGUSTA 109

2 engine mount mouldings
1 fan
1 flywheel
1 drive pulley, 14T
1 starter pulley

4 M3 x 20 socket cap screws
4 M3 x nyloc nuts

Temporarily fit flywheel on engine crankshaft making sure flywheel inner face is properly onto the prop driver. Follow by fan, drive pulley and nut, but note that these are not fitted finally until the engine unit is within the chassis. Place engine between the moulded nylon mounts and line up the rear face of the flywheel near the top front of the mounts. Check that width between the mounts is the same as the spacing on chassis cross member mouldings.

Drill mounts for 3mm engine fitting screws so that spacing is correct - cutting away one vertical stiffener in the mount if necessary. Adjust the position of the throttle lever and fit a ball end from the controls pack at this stage so it can be operated from above.

The silencer must be adapted to point straight downwards or replaced with a 'dustbin' type.

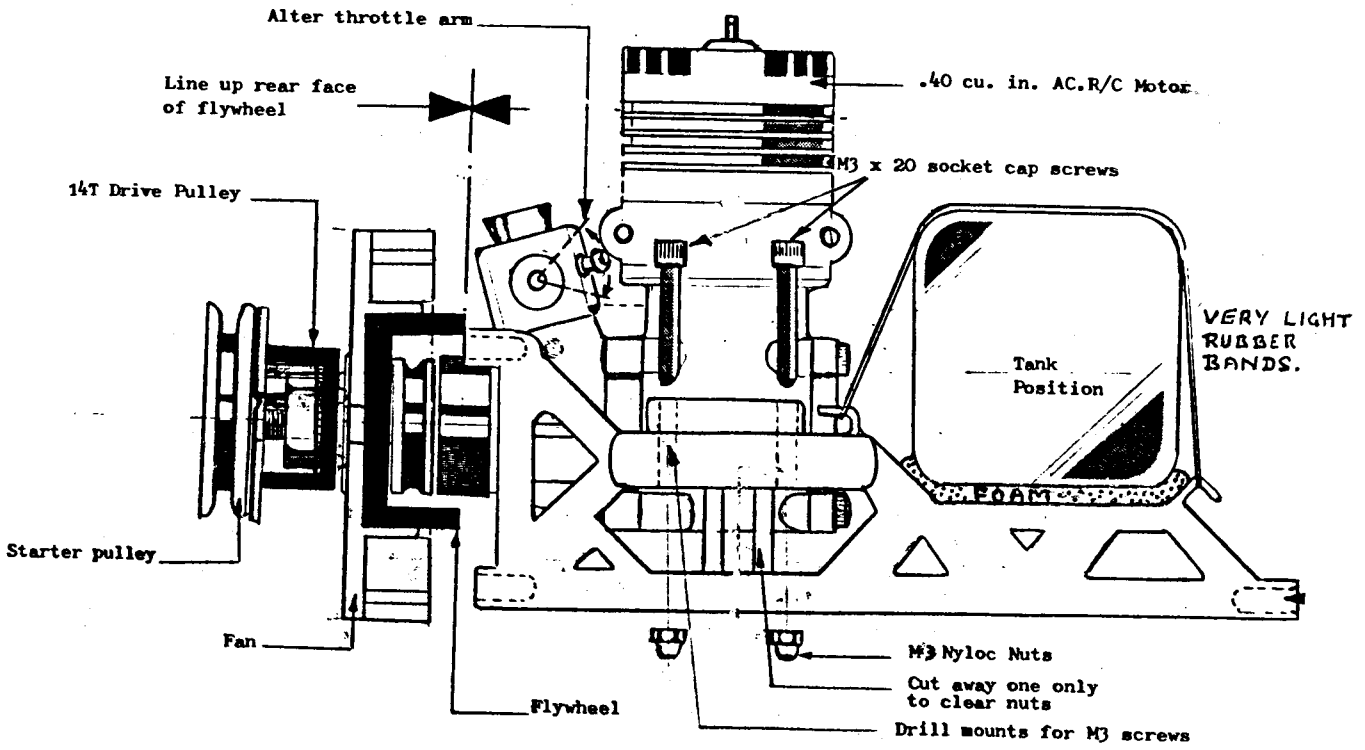
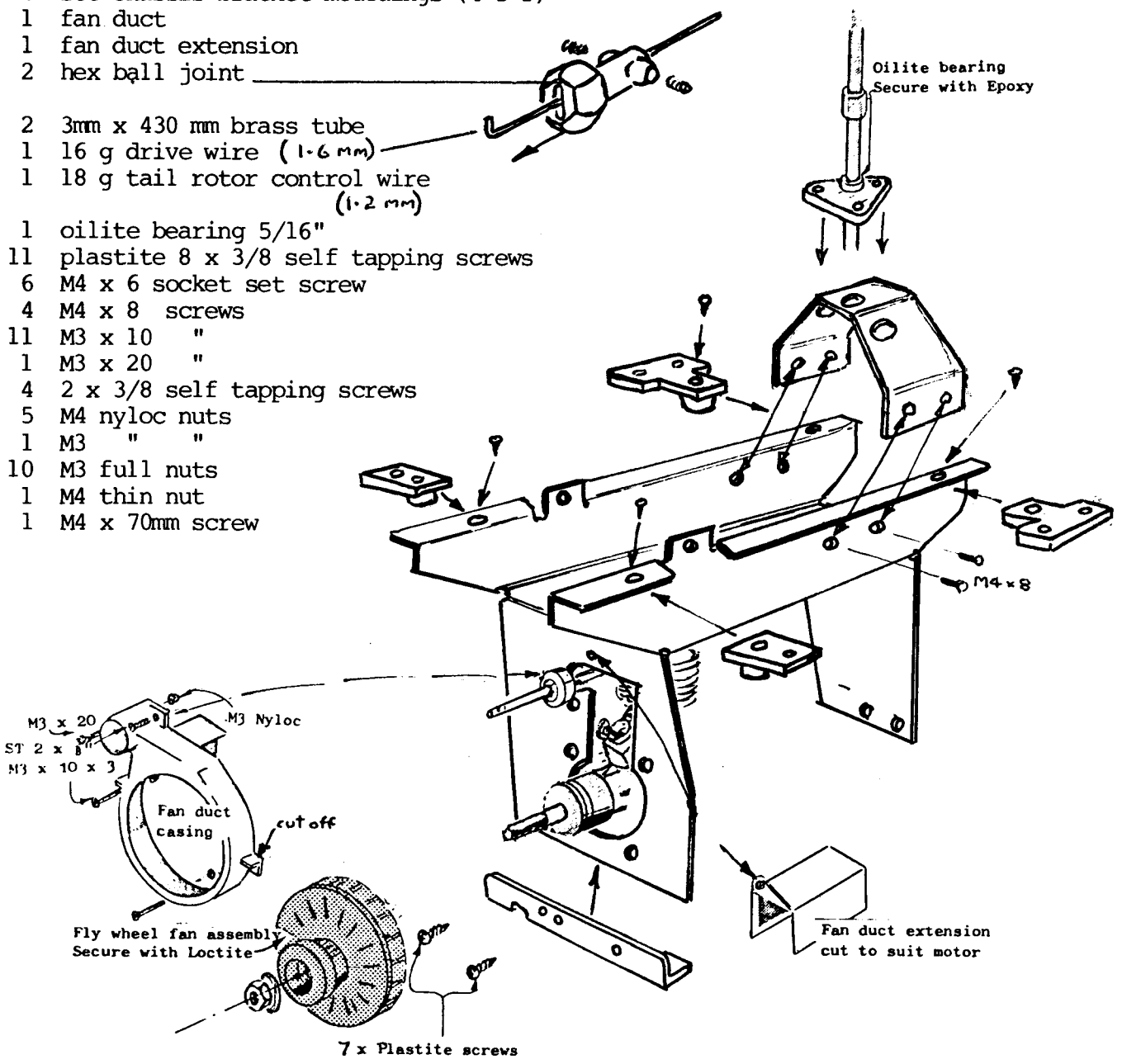


Diagram 3 pack AGUSTA 109 CHASSIS

1 chassis forming (not in pack)
1 mast support frame
1 set chassis bracket mouldings (4+1+1)
1 fan duct
1 fan duct extension
2 hex ball joint
2 3mm x 430 mm brass tube
1 16 g drive wire (1·6 mm)
1 18 g tail rotor control wire (1·2 mm)
1 oilite bearing 5/16"
11 plastite 8 x 3/8 self tapping screws
6 M4 x 6 socket set screw
4 M4 x 8 screws
11 M3 x 10 "
1 M3 x 20 "
4 2 x 3/8 self tapping screws
5 M4 nyloc nuts
1 M3 " "
10 M3 full nuts
1 M4 thin nut
1 M4 x 70mm screw



Place front moulded chassis cross-bracket in position at bottom of chassis. The engine unit can now be fitted to the chassis base plate using self-tap plastite screws. Elongate access hole to glow plug if necessary.

Fix the engine prop-driver, flywheel and fan using locking compound or paint between the surfaces. Fit 'V' section starter pulley over drive pulley using slow epoxy or super glue. An engine backfire on starting will undo this assembly unless it is properly tightened and locked.

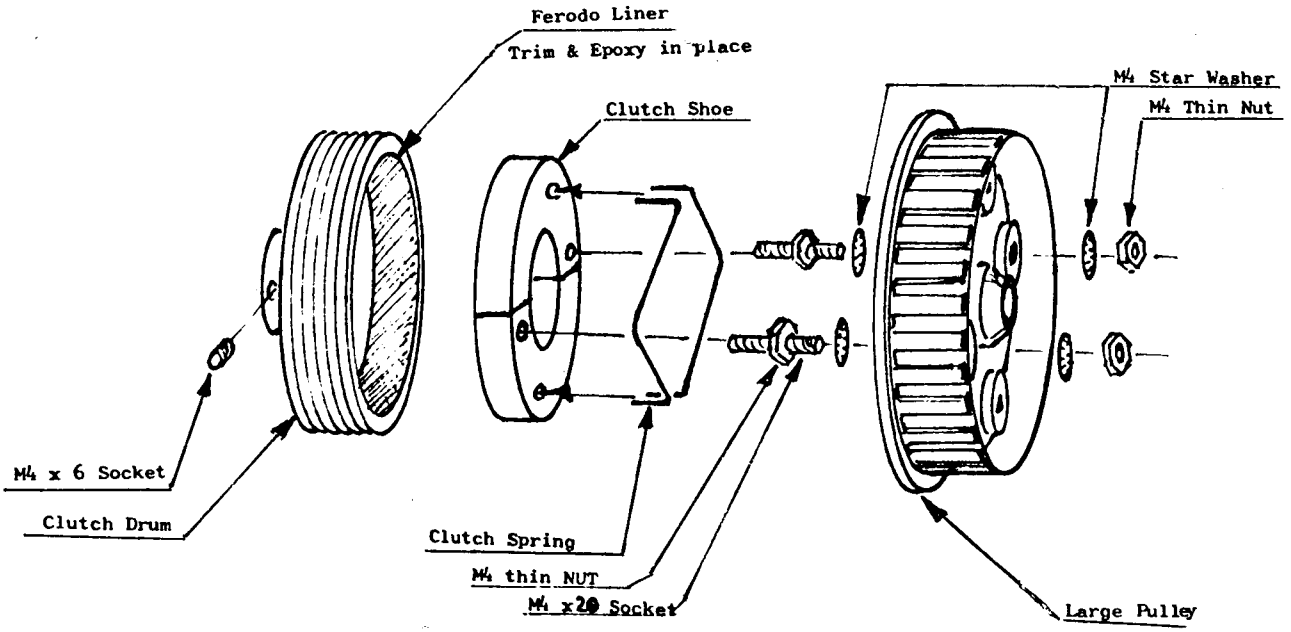
Fit fan duct using 3mm nyloc nut on top screw. Cut off left hand unused tag. Drill chassis and fit moulded duct extension, which may be cut away if necessary to clear the cylinder head. Next fit the aluminium mast support using M4 x 8 screws, followed by the moulded housing for the rotor mast top oilite bearing. **Fit hex socket onto main gearbox shaft using grubscrews, and Lubricate the couplings with a small dab of grease.**
Fit the four upper chassis bracket mouldings to the chassis as shown, using the remaining plastite screws.

The unused nuts and screws are used at a later stage.

Diagram 4 pack CLUTCH UNIT

1 large pulley
1 clutch drum
1 100 XL 037 drive belt
1 Ferodo liner
2 clutch shoe

2 clutch shoe spring
1 M4 x 6 socket set screw
2 M4 x 20 socket set screw
4 M4 thin nut
4 M4 star washer
1 Set screw key



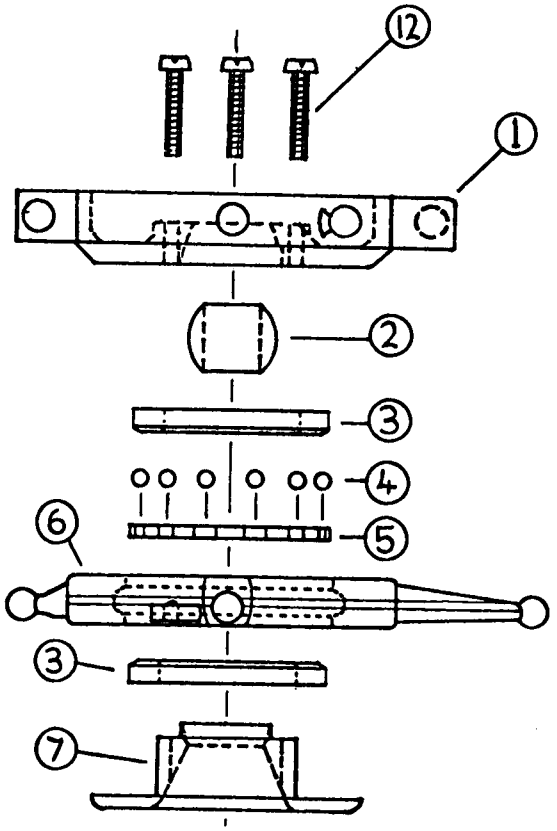
Carefully cut the Ferodo clutch lining to the correct length to fit inside the clutch drum. Roughen the drum with emery paper or a file and cover it and the lining sparingly with epoxy adhesive, then press the lining tightly into place. Hold in position until set.

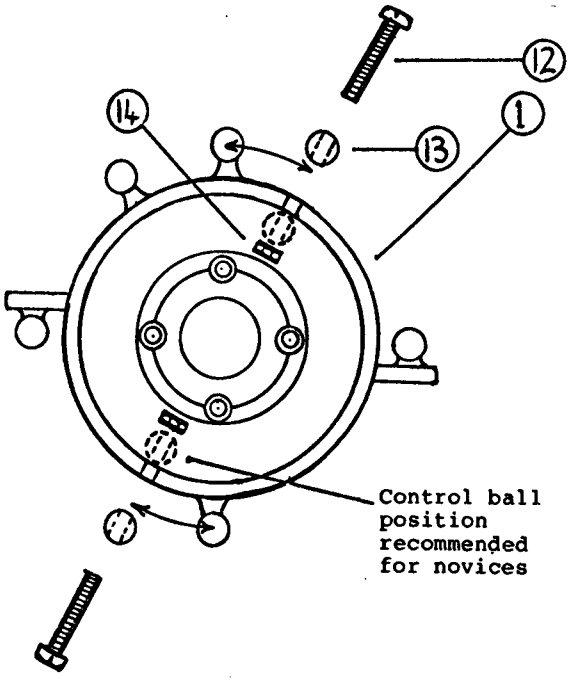
Thread the M4 screws into the clutch shoes and an M4 thin nut one turn clear of the shoe. Locate clutch springs in clutch shoes and add star washers onto screws. Place the assembly into the large pulley as shown in diagram and secure with star washers and thin nuts. Adhesive tape across the shoes is a help while doing this. Check that the shoes are free to swing outwards slightly.

Fit drive belt round engine pulley and slide large pulley onto gearbox input shaft, followed by clutch drum. Align large and small pulleys, and tighten clutch drum grubscrew into flat on input shaft, after applying paint or thread locking compound to the screw only.

SWASHPLATE

STOCK CODE	Diagram key	
OSP/TOP	1	top moulding
OSP/BALL	2	centre ball
OSP/RING	3	small alloy ring (2)
OSP/BRG	4	bearing balls (12)
OSP/CAGE	5	ball cage
OSP/CENTRE	6	centre plate
OSP/BOTTOM	7	bottom moulding
OSP/DRIVER	8	s/p driver assembly
	9	ball eye
	10	2 x 3/8 self tap screws (2)
	11	M4 x 6mm set screw
	12	fixing screws M2 x 12 (6)
	13	brass ball (2)
	14	M2 nut (2)





Any flash on the mouldings should be removed with a sharp knife. Drill a 2mm hole in the swashplate top (1) as shown in the diagram, and fit the brass balls with 2mm screw and nut. Novice pilots are advised to fit the ball to the inside of the cup to reduce rotor sensitivity. (Shown dotted on the diagram).

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 to 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 12 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.

Place on rotor mast with long arm to the rear. (Except for Bell 47 when the long arm goes to the front)

Assemble swashplate driver with No 2 x3/8 self tappers and fit a ball eye (8) to the small pivot.

Swashplate rocking movement must be free and the assembly should slide easily up and down the main rotor mast. Slide the swashplate driver over the mast before fitting rotor head but leave locking to mast until later when the correct position has been found.

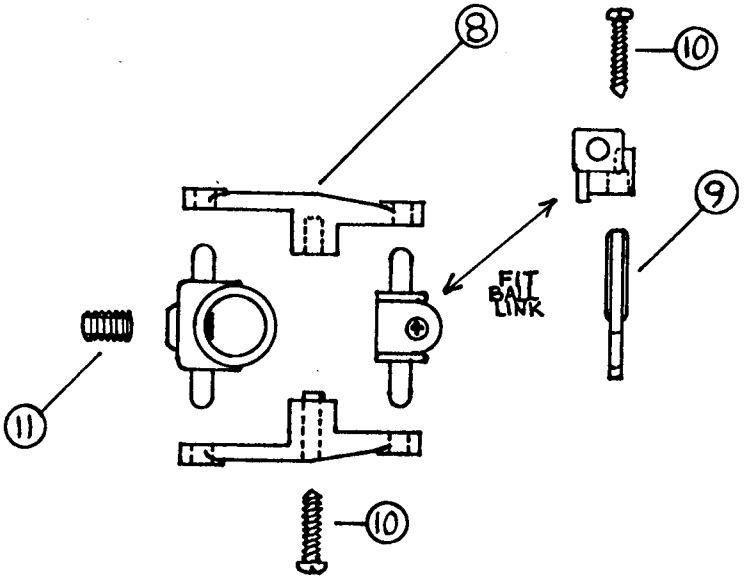
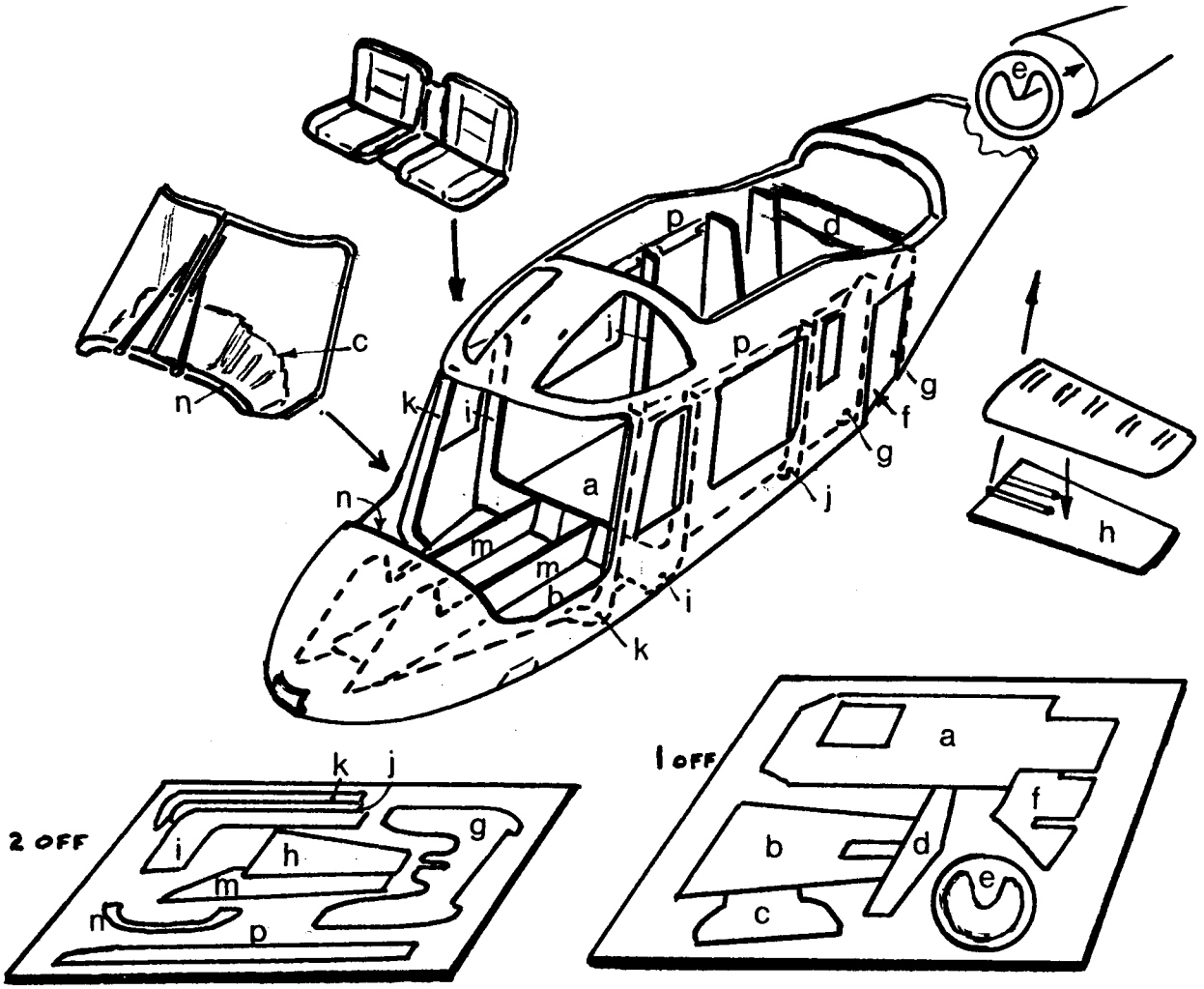


Diagram 6 AGUSTA 109 BODY

1 glass fibre fuselage
1 " " tail portion
1 " " engine bay cowl
1 large diecut plywood sheet
2 small " " "
2 strips of window mouldings etc
1 mounting tube for Tail Rotor gearbox



The purpose at this stage is to prepare the body and principle components for use. Do not fix anything in place.

First cut the openings in the body shell for undercarriage doors, windows etcetera. Use a fine razor saw for the doors. Cut window openings using a minidrill and router or razor saw, and clean up the edges carefully with a fine file. Note that the noseleg hole is narrower than marked, where the plywood floor overlaps it, and also that the main leg doors should be left longer than the scale marking on the fuselage.

The two windows at the pilots feet are not removed to avoid weakening the body, and no clear moulding is provided.

Cut the windows from the clear sheet with a 3mm border.

Prepare the wooden parts. Note that the two main undercarriage bulkheads need sanding to fit, the one used at the rear requiring an increased bottom radius and about 10mm off the top.

Prepare the overlap which joins the tail portion to the body.

Leave cutting the access hole for starting, in the floor of the fuselage, until after the plywood floor is fitted.

Diagram 7 pack

AGUSTA 109
RETRACTABLE UNDERCARRIAGE ASSEMBLY

1 nosewheel
1 noseleg fork moulding
1 noseleg rocker moulding
1 noseleg downlock moulding
2 noseleg frame moulding

4 2 x 3/8 self tap screws
1 M2 x 16 screw
1 M3 x 20 screw
1 M4 x 10 screw

1 operating idler moulding
1 pair pivot blocks
1 pack 8 ball ends and eyes

2 M3 x 20 screws
1 M4 x 25 socket cap screw
2 control rod 37mm
1 " " 85mm
1 " " 340mm
1 straight bellcrank

2 mainwheel
2 main leg moulding
8 crosstube moulding
2 downlock arms moulding
2 " " stop "
2 " " arms wire
2 " " " end moulding
2 door hinge moulding

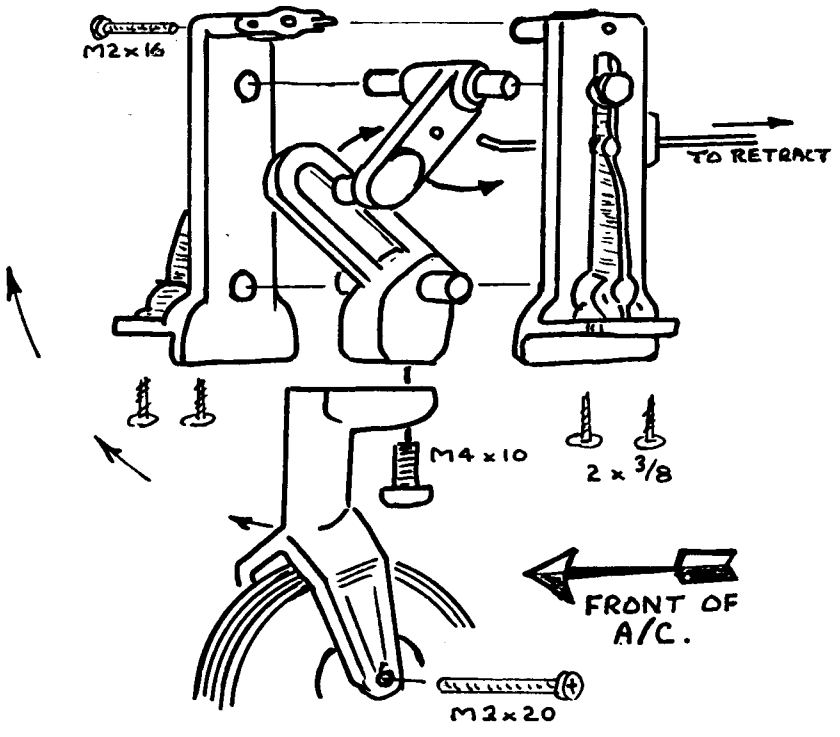
4 4mm x 75mm long pivot
4 M4 x 70 screw
6 M4 nut
2 brass collar
2 M4 x 6 set screw
2 M3 x 12 screw
2 Plastite 8 x 3/8 self tap screw
2 M3 x 30
6 M3 full nut

Noseleg

Assemble to sketch and put by until fuselage is more complete.

Main Undercarriage

The bulkheads (g) have now been shaped to fit the body. Lay the rear bulkhead over the forward one with a 6mm step showing at the bottom. Mark out and drill the holes 4mm diameter. Clamp the bulkheads together when drilling. Positioning is very important to the correct functioning of the retract system. Assemble to sketch and check that the movement is free.



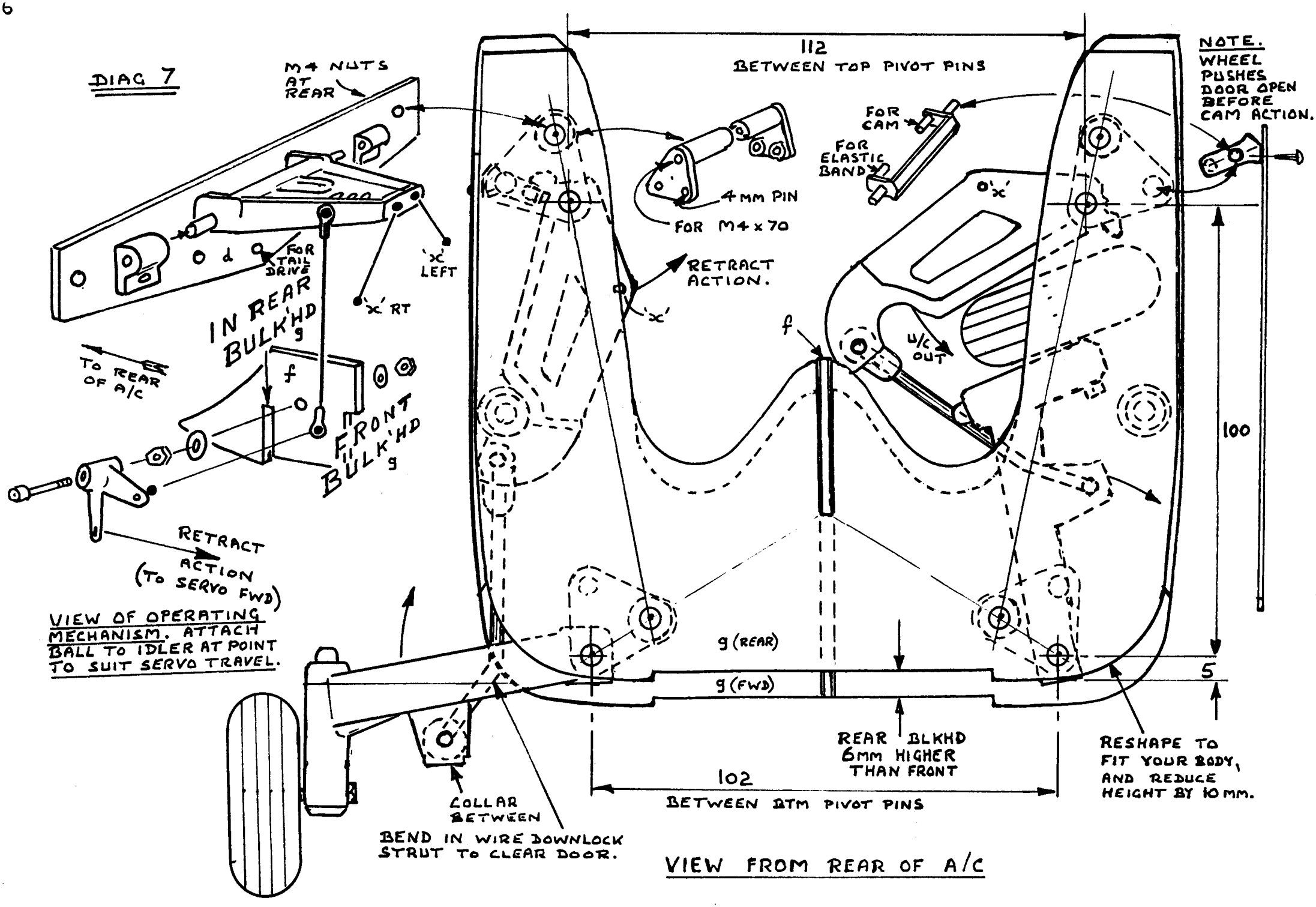

DIAG 7
M4 NUTS AT REAR
FOR TAIL DRIVE
'x' LEFT
'x' RT
IN REAR BULK'HD
g
f
FRONT BULK'HD
g
TO REAR OF A/C
RETRACT ACTION (TO SERVO FWD)
VIEW OF OPERATING MECHANISM. ATTACH BALL TO IDLER AT POINT TO SUIT SERVO TRAVEL.
112
BETWEEN TOP PIVOT PINS
4 mm PIN FOR M4 x 70
RETRACT ACTION.
'x'
FOR CAM
FOR ELASTIC BAND
'x'
f
u/c OUT
NOTE. WHEEL PUSHES DOOR OPEN BEFORE CAM ACTION.
100
g (REAR)
g (FWD)
5
REAR BLKHD 6mm HIGHER THAN FRONT
102
BETWEEN BTM PIVOT PINS
RESHAPE TO FIT YOUR BODY, AND REDUCE HEIGHT BY 10 mm.
COLLAR BETWEEN
BEND IN WIRE DOWNLOCK STRUT TO CLEAR DOOR.
VIEW FROM REAR OF A/C

Diagram 8

AGUSTA 109 RETRACT FITTING

Insert the main undercarriage assembly into the fuselage body and tack with suitable adhesive. The large floor panel (a) should be slid under with the square hole to the left looking forward. Fix down with fibreglass resin or a suitable adhesive for the polyester body shell (e.g. Stabilit Express). Allow to set or cure, weighting the floor to the body on a flat top table. The front floor (b) may also be fixed at this stage and also the bulkheads (g) fully secured.

Drill four holes for the noseleg assembly and fit at the forward fork of floor (b). Check function with a bent wire into hole in noseleg downlock moulding and assess servo position close to this.

Position your retract servo in the left side nose profile (m) and the tail rotor servo in the right nose profile. Securely fix to floor (b) with the ends at join of (b) to (a). Distance apart to suit your servos.

Fit control pushrod from retract servo to main legs bellcrank running approx. 10 mm to right of square hole in (a) and check for correct operation.

Make a bridge piece from scrap ply to fit across the top of the noseleg assembly from left profile (m) to right and secure in position with adhesive.

Main undercarriage doors

With the legs in the down position make sure that the hinge moulding has the pin under the cam on the operating arm moulding. Arrange a rubber band on the pin opposite it, over the crosstube moulding and to a convenient projection (or across to the opposite side) so that the first pin is held firmly up against the cam. Firmly fix the door to the appropriate flat face of the hinge moulding. It may be necessary to pack out to make the sides flush and also to file a little off the downstop moulding.

Replace the rubber band with one that is only strong enough to aid gravity with the door, not stop the undercarriage retracting. Check for action. Possibly a little material may be required to be removed off the bottom of the door to clear the wheel when retracting.

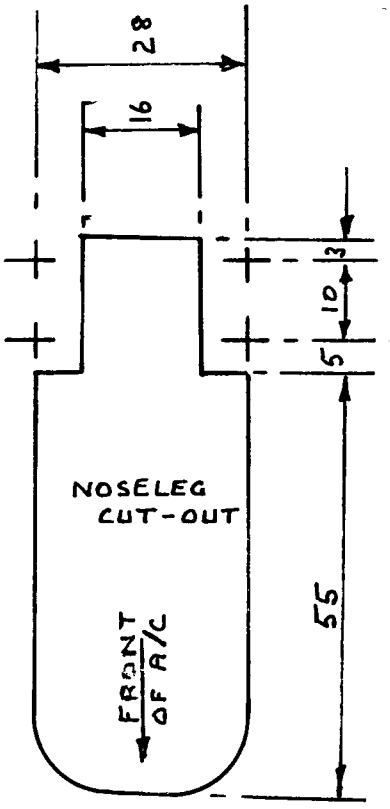


Diagram 9 AGUSTA 109 TAIL END PREPARATION

Make and secure the tailskid.

Cut away the end 15mm of the tail cone and firmly fix in position the tail gearbox mounting tube. Note that this follows the left hand fuselage side and does not point straight down the body.

Build up the inside of the dimple above the tube with scrap ply and make a removeable ply prong for fixing the tail cone.

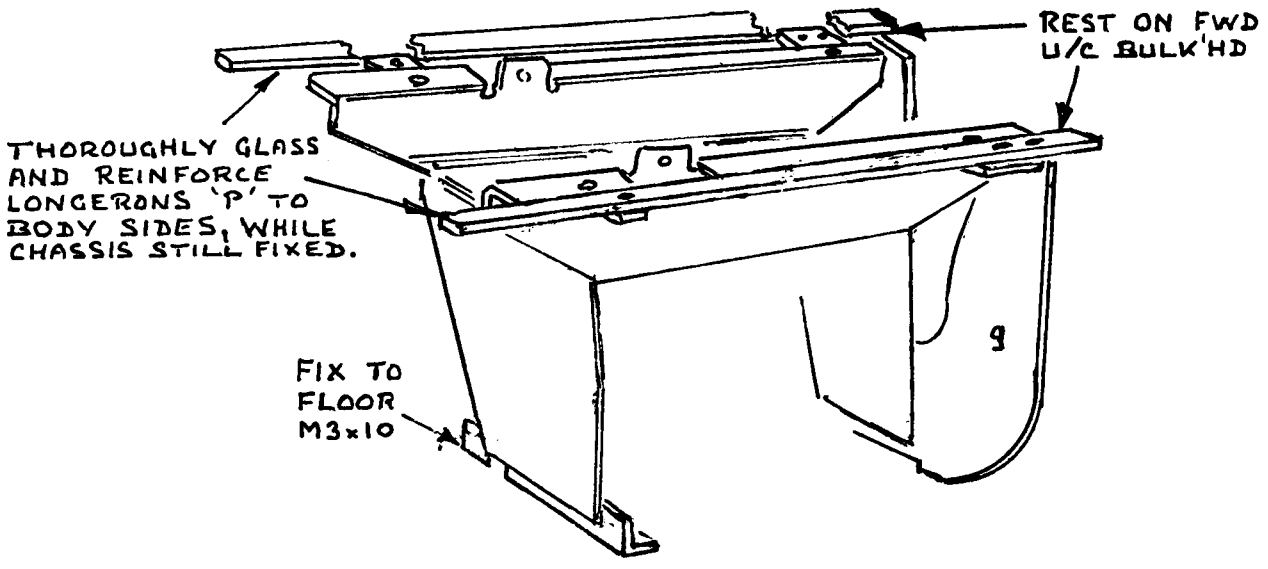
Cut two pieces of drive wire and fit across the fuselage as mounts for the tailplane. These also act as rear support cradle for the tail rotor drive wire tube. Make a hole in the circular former (e) for the drive tube, fit the tube in position.

Diagram 10 AGUSTA 109 BODY & CHASSIS ASSEMBLY

Mark through from the four chassis brackets and then drill and fix the two ply longerons (p) to them so that the overall width suits the body.

With the assembly in the body, drill and fix the bottom bracket to the floor using M3 screws and nuts.

Secure the two longerons (p) to the body shell sides (while still fixed to the chassis) with resin and glass cloth, and similarly fix the rib parts (i,j,k) in position. Refer back to diagram 6 for identification. The hoop (n) may be fixed at this stage also, to the nose section in front of the windscreen. Also fit the tail portion to the main body.



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/YOKE	13	control yoke
0TR/BB2	12	ballrace 6 mm (2)
0TR/CLR	15	control rod collars (2)
ACC/BJ	16	eye end (2)
M3X20SC	18	M3 x 20 socket cap screw
M3N	19	M3 nuts (2)
0TR/CS	20	csk screws 2b.a. (2)
M2X16	21	M2 x 16 screws (4)
M2X12	22	M2 x 12 screws (6)
M2N	23	M2 nuts (14)
ST1	25	2 x 3/8 self tap screws (2)
ACC/BJ	26	ball end ball (2)
0TR/CH	27	M2x12 skt cap screw (2)
M2SW	28	M2 star washer (2)

Remove the oilite bush (7) and push the input shaft (3) into the case as in the diagram. Place the output shaft (4) (i.e. the larger shaft with a hole down the centre) in position in the case (1).

Fill the case with a clean good quality light grease and attach back moulding (2) using M2 x 16 screws (21) and nuts.

Push the oilite bush along the input shaft into the gearcase. 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 holders (10). *Locking with paint or compound is essential.*

Fit a ball end (26) to the pitch control arm of the blade holder using M2 x 12 screw (22) and a nut (23) on each side of the arm. Repeat with the second ballrace and holder.

Clamp the ballraces between the moulded hub halves (11) and draw halves together using M2 x 12 screws (22) and nuts (23). Do not apply adhesive.

File small flats on the output shaft (4) of the gearbox to seat the set screws, and fit tail rotor hub to output shaft. Do not overtighten the grub screws.

☞ Note that the outer surface of the hub should be flush with the end of the shaft.

Cut a 4inch (10cm) length from the 16g wire supplied and bend as shown for the pitch control rod (17). The wire passes through the centre of the shaft and moves the pitch control yoke (13) which is positioned between two collars (15).

A plastic ball eye (16) is fitted to each end of the yoke (13) with a self tap screw (25). The bellcrank (14) pivots on a 3mm bolt (18) on the arm protruding from the gearcase back, again with a nut both sides of the arm.

Slot the blades (9) into the holders (10), making sure they are leading edge forward (curved surface towards the gearbox, except Bell 47 when flat surface is towards the gearbox), and hold with M2 x 12 socket cap screw, star washer and nut. Refer to the diagram for correct installation.

☞ The groove in the main case of the tail rotor gearbox is a guide for the 18g control wire.

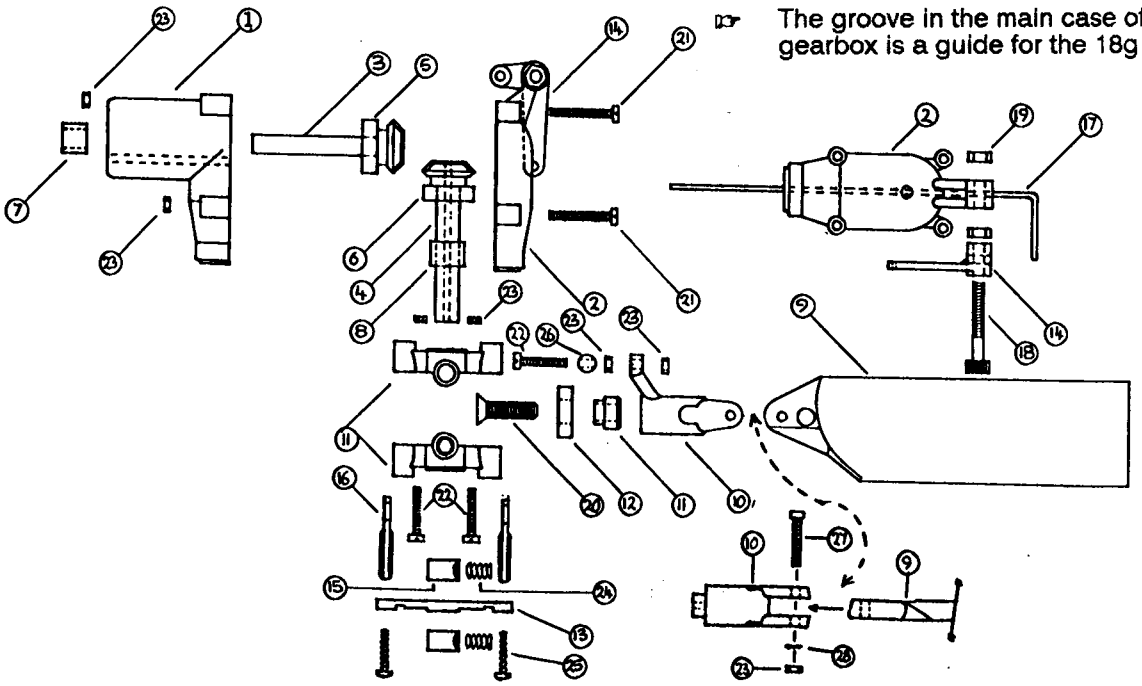
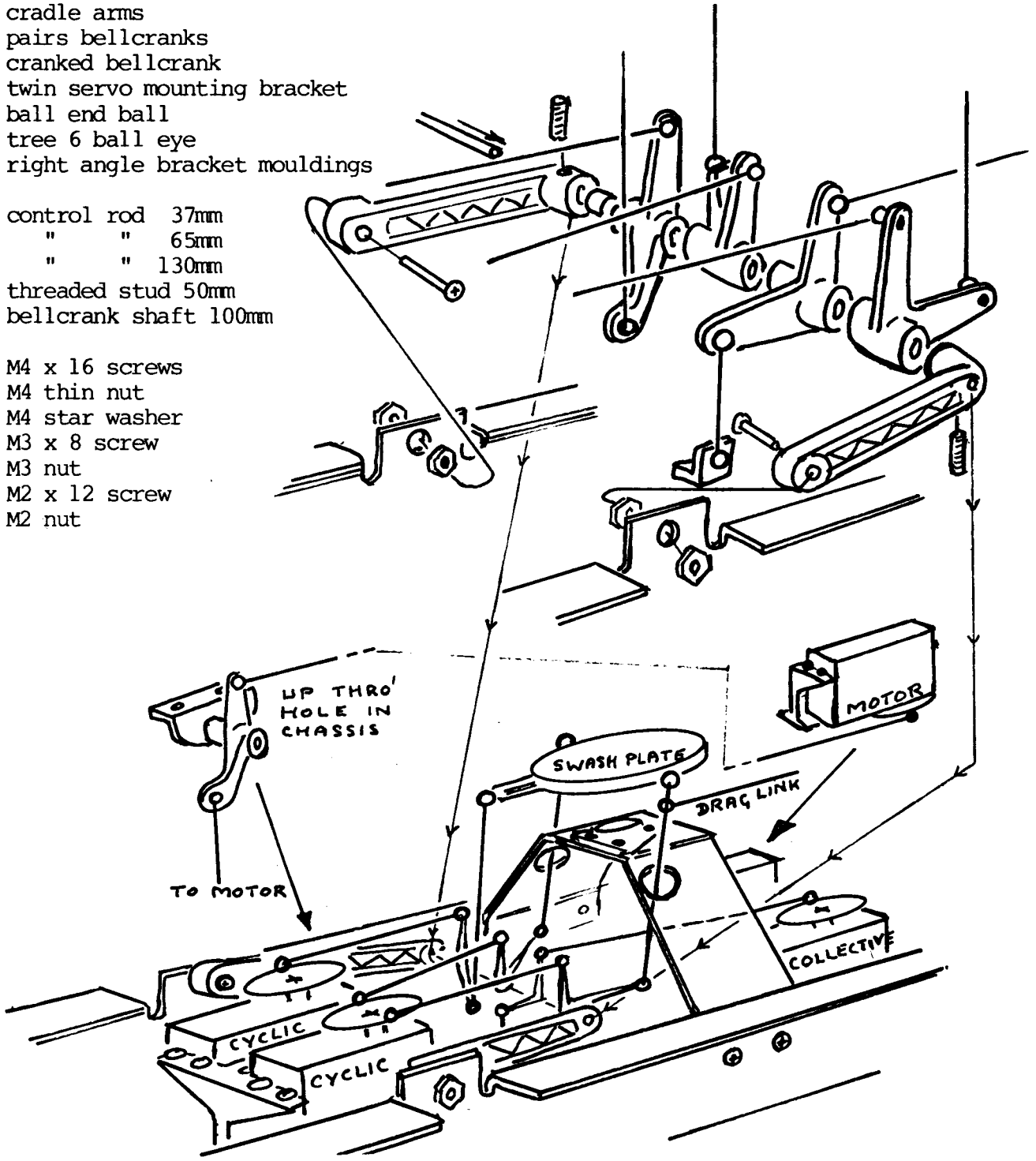


Diagram 14, 15 pack

AGUSTA 109 CONTROLS

2	cradle arms
2	pairs bellcranks
1	cranked bellcrank
3	twin servo mounting bracket
18	ball end ball
3	tree 6 ball eye
2	right angle bracket mouldings
4	control rod 37mm
4	" " 65mm
2	" " 130mm
1	threaded stud 50mm
1	bellcrank shaft 100mm
2	M4 x 16 screws
4	M4 thin nut
2	M4 star washer
8	M3 x 8 screw
8	M3 nut
18	M2 x 12 screw
20	M2 nut



Remove the chassis from the fuselage body.

Make up the bellcrank cradle as shown and fix across the chassis. Make sure that you have a good flat under the set screws in the cradle arms.

The cyclic servos are mounted together on one of the twin servo mounts between the bellcrank cradle. The collective servo is on another mount from which the surplus arms must be removed. Fix in position at the left hand rear of the chassis. The other arm of the bellcrank it is linked to is then connected to the chassis with a short link of two ball eyes.

The throttle servo is mounted disc down on the third bracket, control to go forward to a cranked bellcrank mounted under the chassis, the arm coming up through the hole.

Make up the support control rods and fit the swashplate. Complete the control runs from the tail rotor and retract servos.

Diagram 16 AGUSTA 109 BODY FITTINGS

The roof access panel glass fibre moulding is split across the centre panel line. The front portion has two dowels going forward into the body and a flange to fit under the rear panel. The rear panel has two dowels securing the rear end under the rear fuselage bulkhead. The whole assembly is held in position by a single nut disguised as a navigation light which screws onto the M4 x 70 bolt fixed into the stay which is made from scrap ply and goes from the mast support frame to the body.

The tail planes are made from two mouldings cemented over the ply outline which is sanded to shape. Two short lengths of brass tube are cemented to mate up with the wires in the body so that the tailplane halves can be pushed on.

The tail cone halves are cut from the sheet moulding and butted together before cementing to the removeable ply prong. (see 9)

The scale jet outlet pipes are cut from the sheet so that the two stubs go into holes cut in the flat of the moulding. The angled outlets should also have holes in the body shell to aid in cooling and exhaust.

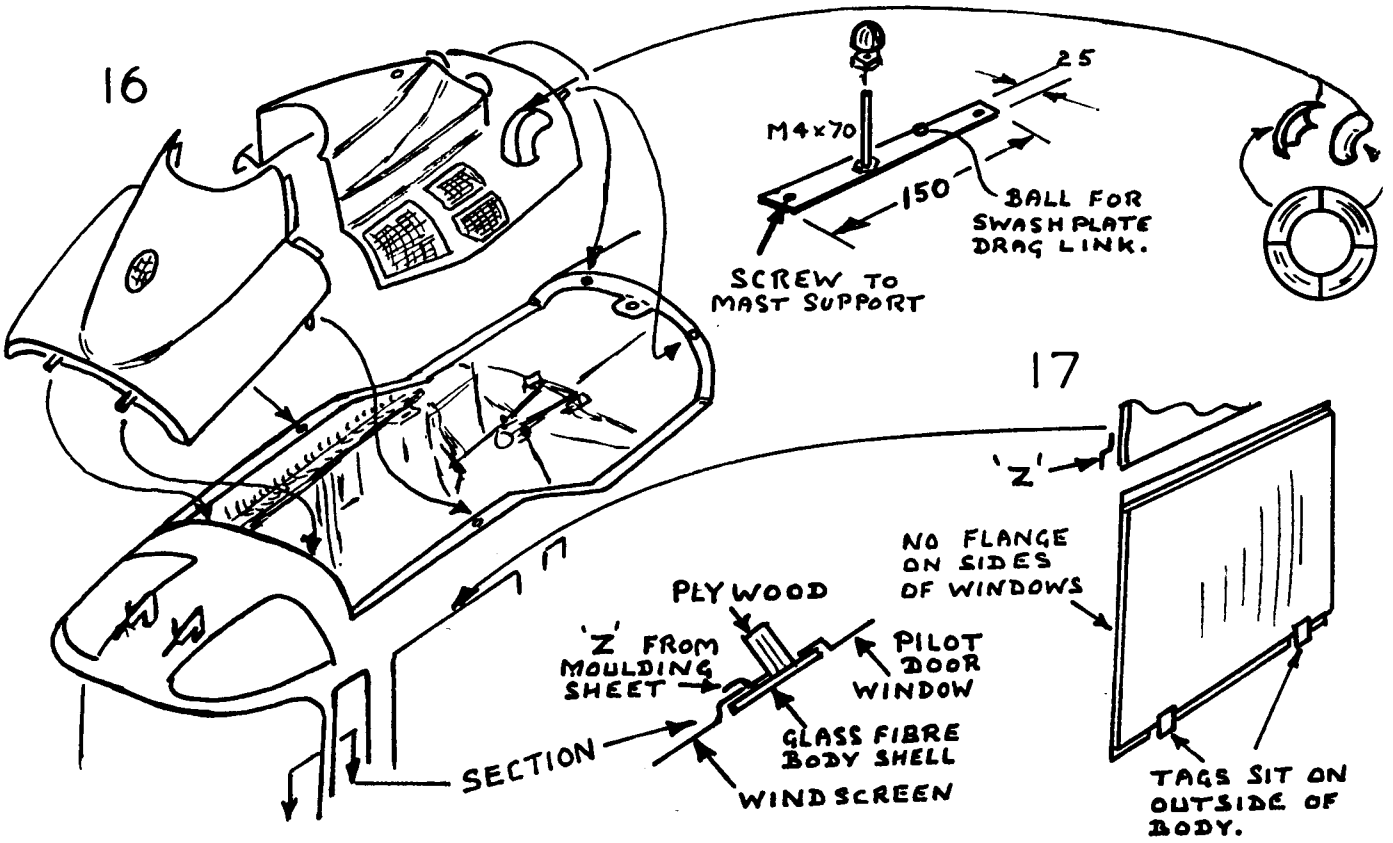


Diagram 17 AGUSTA 109 PAINTING & WINDOWS

The fibreglass moulding should be lightly flatted with wet & dry before painting to the desired colour scheme. Do not use a lot of paint as this would hide the panel lines. These may be emphasised with a soft pencil before fuel proofing.

Refer back to diagram 6 to see how the windscreen is fitted to the second hoop and the instrument cowl under it. The unit is held on by the self tap screws through the windscreen wipers which are cemented to the windscreen. The door pillars have the 'Z' section cemented to them so that the windscreen sides are held in position.

The pilot's door windows and ceiling windows may be cemented in place, also two small windows to the rear of the cabin.

The main side windows are removeable for flying as shown in the sketch.

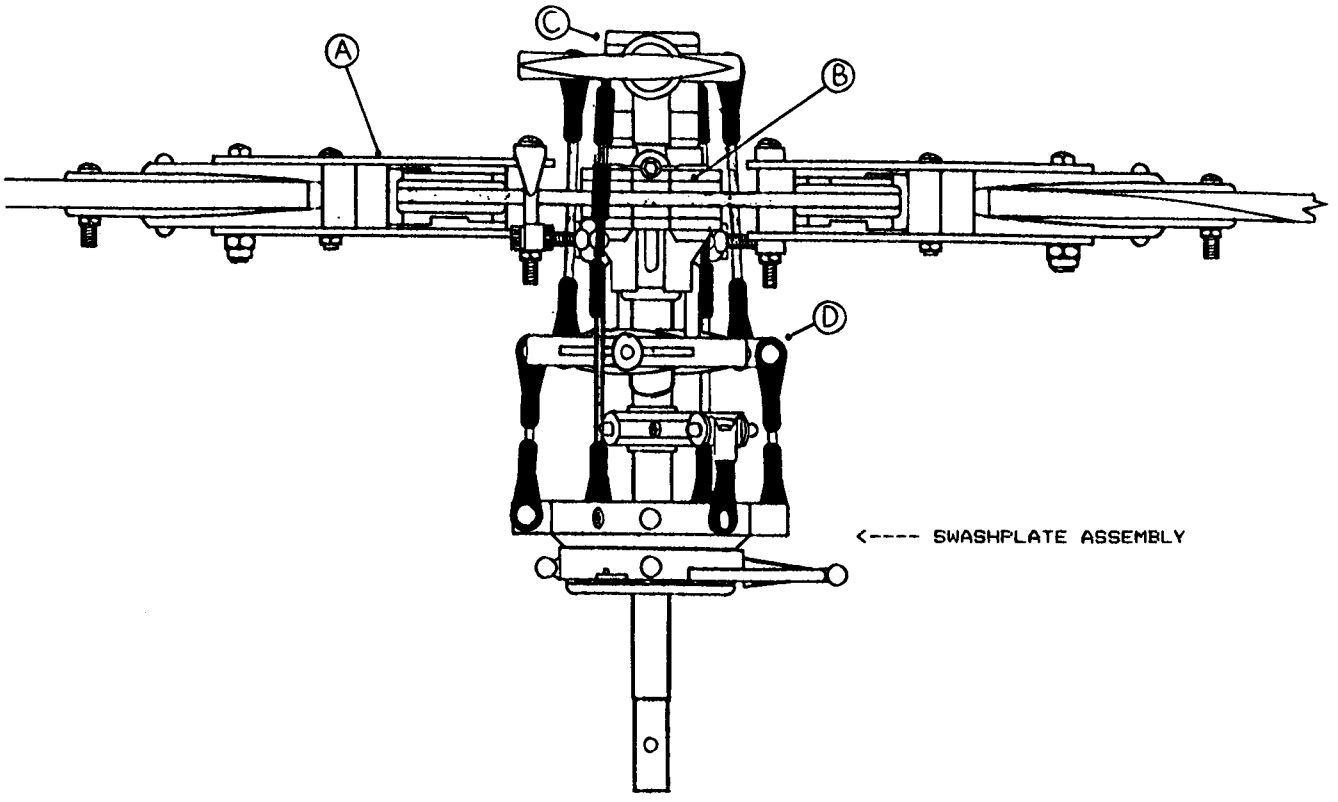
STOCK CODE	Diagram key	
ORH/PLATE	1	head plate
ORH/FINGS	2	set of 4 finger plates
ORH/TOP	3	top plate moulding
ORH/MT	4	mast top moulding
ORH/RUBS)	5	teeter rubber
" ")	5	drag damper rubber
ORH/BM	6	blade mount
ORH/BRG	7	bearing mount pairs
ORH/CRADLE	8	cradle carrier
ORH/FBZZ	9	flybar cradle (zig zag)
ORH/FB	10	flyblade
ORH/FBOA	11	flybar operating arm
ORH/IA	12	incidence arm
ORH/FBAR	13	flybar (not in pack)
ORH/BB	14	6mm ballrace
	15	3mm oilite bearing
	17	square brass collar
BLADES		main rotor blade (not in pack)
ORH/MIX)	18	mixer short rocker
" ")	19	mixer long rocker
" ")	20	mixer slider
		50mm threaded stud
		37mm control rod
		ball eye mouldings
		M3 star washer
	21	M2 x 12 screw
	22	M2 nut
	23	M3 x 16 cap head screw
	24	M3 x 20 cap head screw (plain shank)
	25	M3 x 20 cap head screw
	26	M3 x 20 pan head screw
	27	M3 x 30 pan head screw
	28	M3 nut
	29	M4 x 10 socket set screw
	30	M4 x 25 plain shank screw
	31	M4 nyloc nut
	32	ball end ball
	33	M3 x 16 pan head screw
	34	M3 x 30 cap head screw

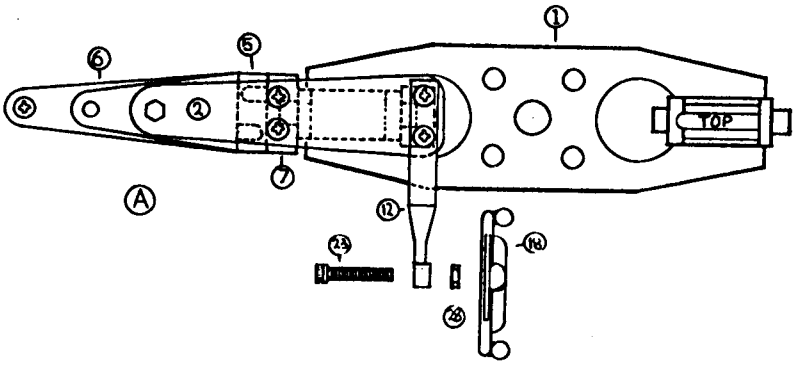
Mixer Assembly

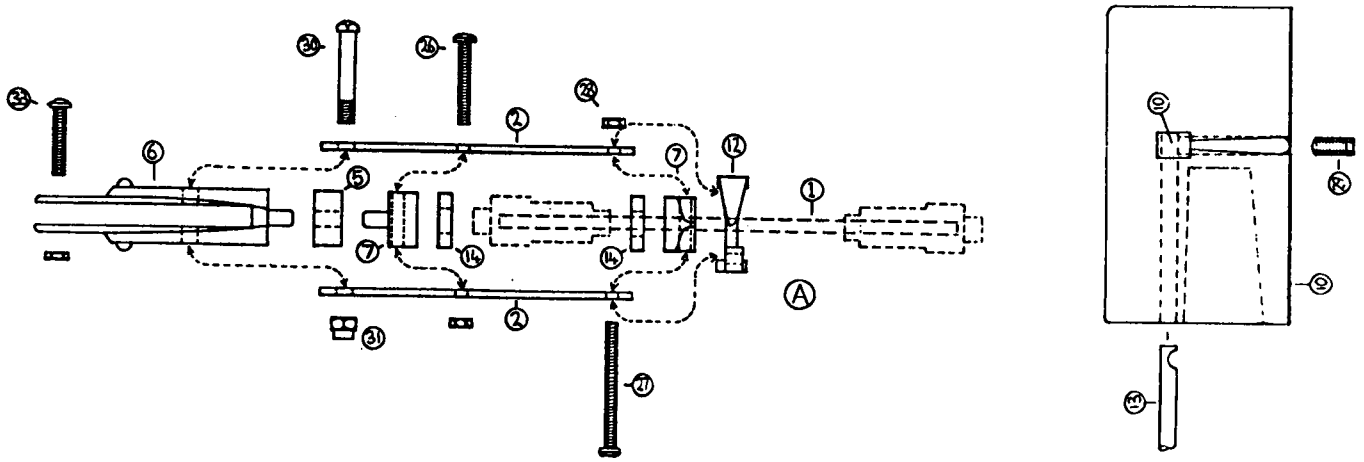
Cut the 50mm threaded stud into four equal lengths and fit a moulded ball eye to each end of each stud.

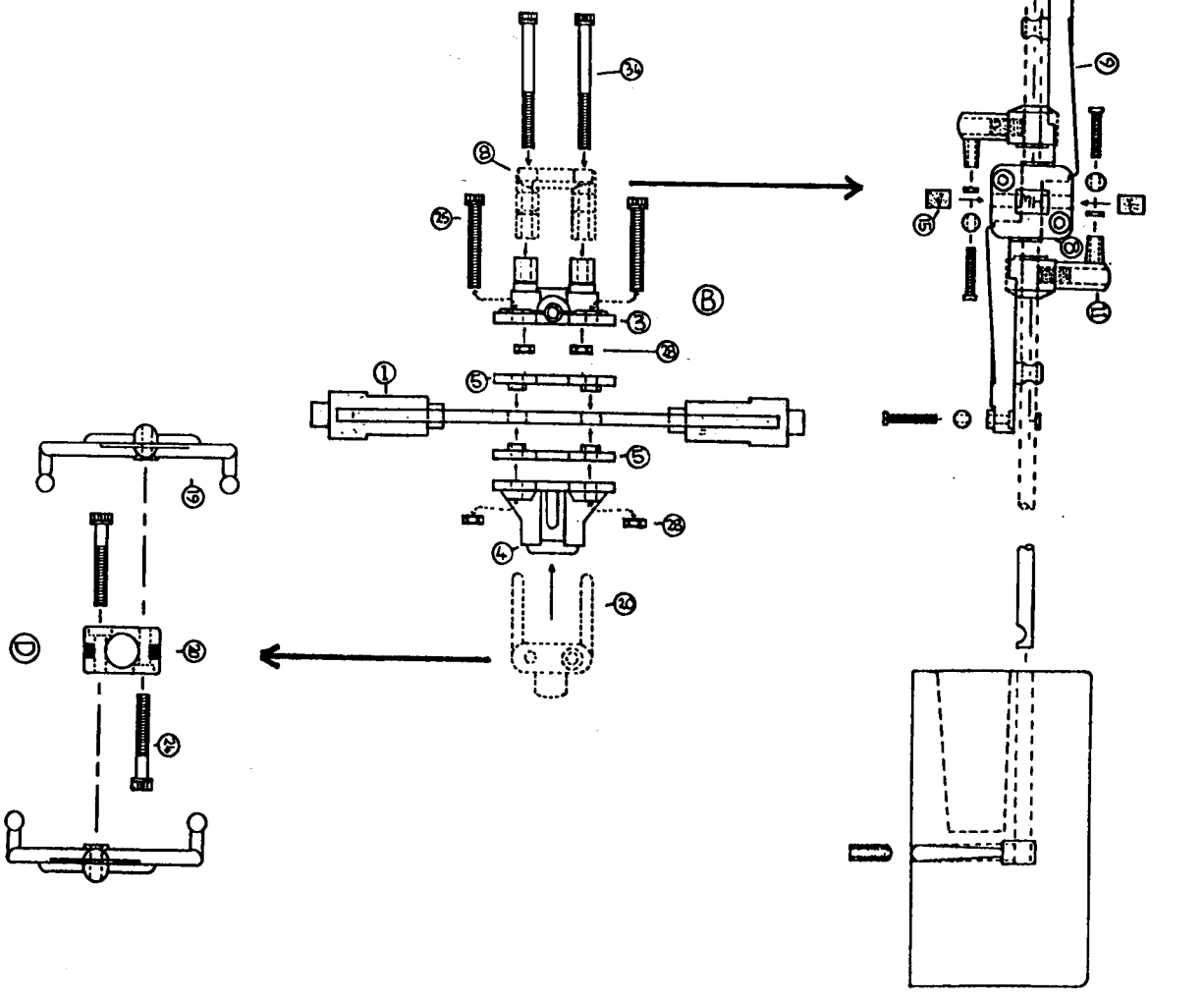
Pass an M3 x 20 cap head screw with a smooth shank (24) through the holes in each side of the mixer slider (20) as in sketch 'D'. The smooth shank acts as a pivot, so use some light grease. Thread the screws into the long rocker arms (19), allowing it to cut its own thread in the plastic. The arms must be allowed to move freely but without slop.

Slide the mixer slider onto the rotor mast with the fork fitting upwards to go into the grooves in the side of the mast top moulding. Connect the outer arms of the long rocker arms to the outer balls of the swashplate using two of the four ball eye and stud connectors.




TOP
A


A


B

Insert an M3 x 16 cap head screw (23) through the pitch control hole in the two rotor blade incidence arms (12), and fix with M3 nut (28) as shown in sketch 'A'

Push the four ballbearings (14) onto the stub axles moulded into the rotor head alloy plate (1). Note the word 'TOP' is marked on the stub axle. Lightly grease the bearings when in position. Fit the moulded bearing block (7) to the outer ballrace with the moulded stud to the trailing edge (anti-clockwise rotation). Assemble two steel fingers (2) onto the block using M3 x 20 pan head (cross head) screws (26), star washers and nuts (28). Fit the inner bearing block (7) over the inner ballrace, between the steel fingers. Push the moulded incidence arm (12) over the fingers and fit using 2 M3 x 30 pan head screws (27) through the inner bearing block followed by star washers and nuts (28).

Refer to sketch 'B'. Push mast top (4) onto mast. Remove rotor head fixing screw from inside the top plate moulding (3). Remove any flash remaining from the moulding. Place two M3 nut in the recesses in the base.

Sandwich the headplate (1) between the two teeter rubbers (5) and between the mast top and top plate moulding. Assemble using four M3 x 20 cap head screws (25) threaded full length and M3 flat nuts (28). Make sure the nuts are pulled home and the teeter rubbers are lightly clamped. Replace screw in top plate moulding, through mast.

Fit a brass ball to each end of the flybar cradle `zig zag` using M2 screws and nuts, taking care to fit it on the side opposite the flybar position.

Snap the 'zig-zag' into the moulded carrier (8) and then push in the oilite bearings (15) over the small pivot shaft. Pass the fly bar (13) through the cradle, threading in the operating arms (11) as required. The unit is fixed to the rotor head top moulding using 2 M3 x 30 socket cap screws (34) passing through the cradle and into the two M3 nuts in the top moulding (3). (Sketch 'C').

Refer to sketch C. The flyblades (10) are fitted to the flybar (13) as in the sketch with the M4 x 10 socket set screws (29) passing through the rear of the flyblade into the square brass collet (10), and fitting <u>into the deep grooves</u> at the end of the flybar. Note that the trailing edge of the flyblade is square and not sharp.

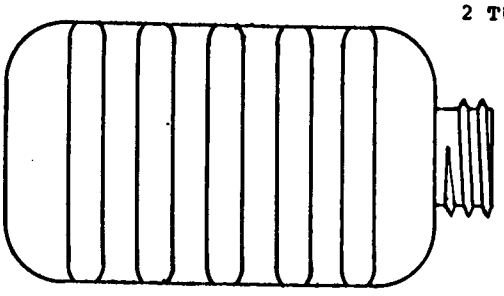
Fit a moulded ball eye to each end of the 37mm pushrods and use them to connect the flybar operating arms (11) to the inner balls on the mixer/rocker assembly. The flyblades (10) must be in line with each other. When satisfied, set the operating arms (11) in line with the flyblades and tighten the grubscrews.

Thread a small rocker arm (18) onto the M3 bolt (23) on each incidence arm (12), and use the two remaining short connecting rods to link the ends of the 'zig-zag' cradles to the long arm of the small rockers.

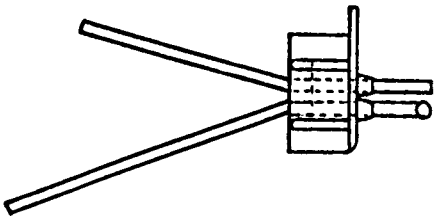
Thread moulded ball eyes onto the 37mm rods and use to connect the brass balls you have fitted on the swashplate cup to the short rocker on the incidence arms.

Lubricate all moving parts. Plastic on plastic should be lubricated with vaseline or similar e.g. mixer slider.

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



2 TUBES SIDE BY SIDE,
FOR VENT OR PRESSURE, AND FILL



1 TUBE AT BOTTOM OF TANK FOR ENGINE FEED

Cut away the balsa at the blade roots to taper the blades, and if necessary flatten the top of the blade where it fits into the moulded holder (6), (holder peg to the front). Sand the blades lightly to smooth the surface then cover with the self-adhesive vinyl supplied. The overlapping edges should be under the blade trailing edge 'downwind' - (see diagram).

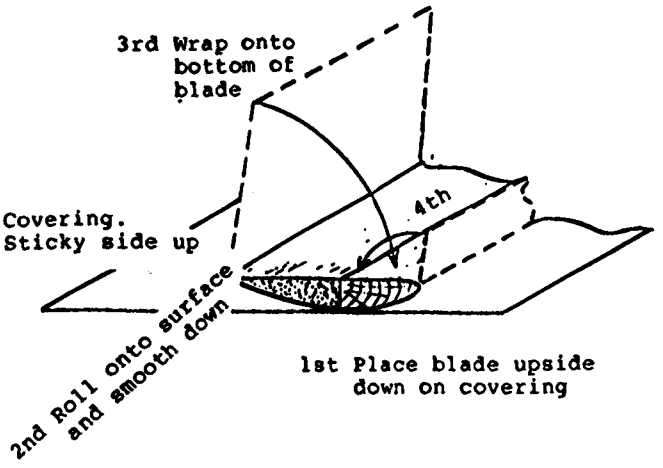
BLADE BALANCE

The rotor blades must be in static and dynamic balance. To achieve this is simply a case of making sure they have the same weight, and that the centre of gravity of each blade is at the same point.

If the blades are of equal weight but differing C. of G., add covering material or electrical tape to move the balance point of one blade out towards the tip, and a similar amount of material to the other blade to bring the balance point towards the centre. Try and get the balance equal to within 1-2mm.

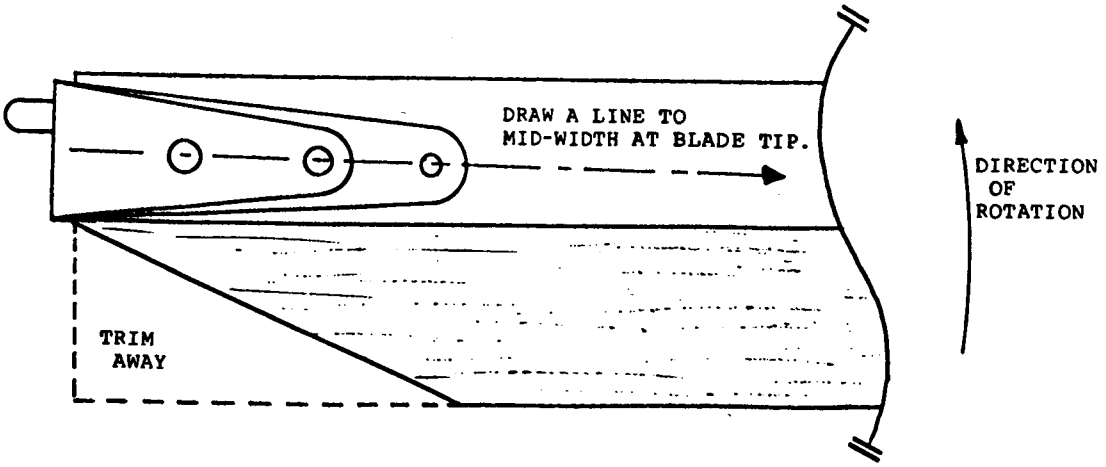
If the blades are of unequal weight and balance point, add covering material to the lighter blade in such a position that it will also move the balance point to match the other blade.

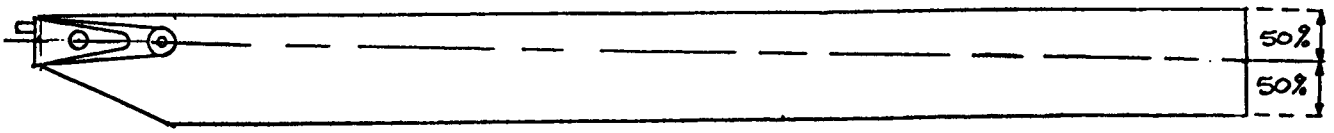
BLADES

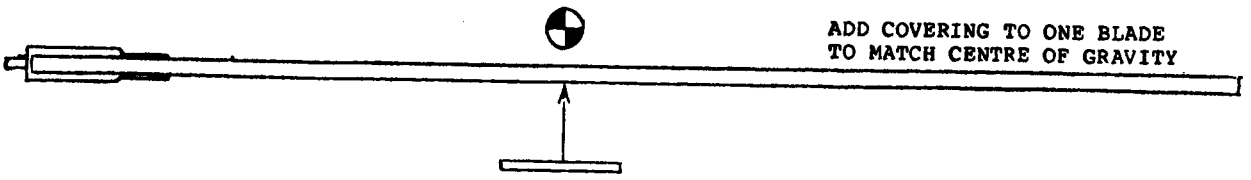


Insert the blades in the blade holders (6) and position so that a line from the two holes in the holders would extend to a point 50% back from the leading edge at the blade tip. This gives the correct amount of blade lead. Drill and fit the M3 x 16 (33) bolt and nut, then drill for the larger 4mm retaining bolt (36) and fit. Place the rubber drag dampers (5) in position and push the complete blade assembly in place between the rotor head fingers using M4 screw (30) and nyloc nut (31) to secure.

Paint or tape one rotor tip red and the other white or yellow, or use Morley Helicopters dayglo tape, part no ACC/GLOW. Check that each tip in turn is the same height above the boom by turning the rotor until one blade is over the boom, measuring the distance down, then turning the rotor 180 degrees so the second blade is over the boom, and measuring that distance. This is static tracking and is very important.







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 0 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.

The model will move in the direction of tilt of the main rotor disc, which follows the same tilt of the swashplate. 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 angular 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 0 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.

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. Some people prefer to fly other modes. 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 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. Note that moving the cyclic stick will tilt the rotor.

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, a great excess of collective pitch will 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 model screams and 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 2/3 to 3/4 of full throttle stick movement. Main rotor should be turning at approx 1100 rpm, equivalent to 4500 at the tail rotor.

Oscillations can also occur with any 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.

FLYING

There are a great many technicalities concerned with the flight of a helicopter, only the essential reactions will be related here.

Start by standing about three paces to the rear and three paces to the side of your model which is pointing into wind and on level ground. This is the best position for observing the attitude of the model and to be able to control the hover.

Increasing throttle/collective to the point of lift off will indicate that the model wants to go in one direction or another. Apply a control (the cyclic control is as if you had hold of the model by the rotor top) to correct the movement. You can trim out the tail at this stage. Repeat until you are confident that your reactions will give a control in the right direction.

A touch more collective and the model will clear the ground. If at this stage it persistently goes in one direction the trim may be adjusted, either on the transmitter or by adjusting the length of the control rods to the swashplate. Repeat until confident.

When the model is one metre clear of the ground (out of ground effect) control will be easier but a miscontrol will be more disastrous. If flying from rough grass then Morley floats (order No ACC/FLTS) can be an advantage, other training aids are more trouble than they are worth but the Morley string method may help.

A 30cm length of light dowel is used to make an extension to the tail boom, to provide an attachment for a 3 metre length of cord clear of the tail rotor. An active and understanding anchor man holds the other end with the model pointing <u>downwind</u>. The model has forward trim set and the pilot stands to the left of the anchor man, who raises and lowers the string with the model. In this way the pilot learns the response of the model two controls at a time instead of having all four to worry about. This method has been tried, and it works.

When you find that height control (do not let the model go above head height) and lateral control are an automatic reaction, then the forward trim is removed and the fore and aft cyclic becomes operational. As the string goes slack so the tail rotor control is needed. Persist until you find it easy. Try to get used to settling the model down - landing - rather than slamming the throttle shut when in the right place else you may chop the tail boom.

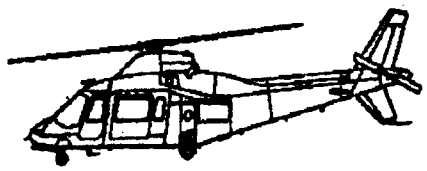
Now you can hover! Which you need to do to land. Follow this with slow flights forward, backwards and sideways until you can place the model at any point you want, and can keep it there.

The next stage is a circuit, which is easy, but coming out of forward flight back to the hover is not always so. On a calm day a circuit is just a hovering circle. Note that the controls are used to change the attitude of the model to position it as required, and not 'held' in any particular way. Note also that in forward flight a lot less power is required - this is caused by the addition of translational lift due to the extra air going through the rotor, and is what can give rise to trouble in stopping.

To slow down, gently reduce collective and bring the nose up slightly, but before the model stops travelling forward the attitude must be brought back to level and the power increased a lot to stop sink. Almost immediately slightly reduce power to stop a vertical climbout. You can then settle it down.

Happy Landings

Jim Morley



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M3X10	M3 x 10mm screws (10)	0.80
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M4NLN	M4 nyloc nuts (10)	0.80
M4SW	M4 star washers (20)	0.45
M4X8	M4 x 8mm screws (10)	1.25
M4X10	M4 x 10mm screws (10)	1.30
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0CON/SH75	Bellcrank pivot (75mm)	0.35
0CON/SH100	Bellcrank pivot (100mm)	0.40
0CON/SMNT	Single servo mounting brackets	0.85
0CON/SP	Bellcrank spacer (Bell 47) pair	0.30
0CON/SSSM	Single side servo mount	1.00
0CON/STUD	Pushrod connector stud (2)	0.50
0CON/TMNT	Twin servo mounting bracket	1.50
0CON/TUBE	200mm Alloy tube (MXA)	0.80

TAIL ROTOR

0TR/BB1	3/16" ballrace	4.20
0TR/BB2	6mm ballrace	4.20
0TR/BL	Tail rotor blades pair	2.80
0TR/BM	Tail rotor blademounts&screws	3.50
0TR/C1	Tail rotor main gearcase	1.75
0TR/C2	Tail rotor gearcase back	1.30
0TR/CH	T/R blade M2 screws and nuts	0.80
0TR/CLR	Pitch control rod collars pair	0.65
0TR/CRANK	Pitch operating bellcrank	0.70
0TR/CS	C/sunk blade mount screws	0.60
0TR/GIN	T/R input gear and shaft	3.60
0TR/GOUT	T/R output gear and shaft	3.60
0TR/HUB	T/R hub & spacers	2.95
0TR/OIL1	3/16" oilite bearing	0.80
0TR/OIL2	6mm oilite bearing	0.80
0TR/YOKE	Blade pitch control yoke	0.95

ROTOR HEADS

0RH/2	Two blade rotor head	51.95
0RH/3	Three blade rotor head	62.95
0RH/4	Four blade rotor head	72.95
0RH/HEAD3	Three blade conversion pack	34.95
0RH/HEAD4	Four blade conversion pack	43.95

ROTOR HEAD PARTS

0RH/BB	6 mm ball race	4.20
0RH/BGM	Bearing mounts (1 blade) pair	1.15
0RH/BM	Main blade holder & mount	1.50
0RH/CRADLE	Flybar & zig zag cradle	1.15
0RH/FBZZ	Flybar carrier zig-zag	2.95
0RH/FB	2 Flyblades,collars&screws	4.60
0RH/FBAR	Fly bar	1.75
0RH/FBOA	Fly bar operating arm each	1.25
0RH/FINGS	Blade mount finger plates (2)	1.60
0RH/IA	Main blade incidence arm	1.15
0RH/MIX	Bell/Hiller mixer sprue	2.35
0RH/MT	Rotor mast top	1.15
0RH/OIL	3mm oilite bearing pair	1.25
0RH/PLATE	Rotor head hub plate	9.95
0RH/PLATE3	Alloy head plate (3 blades)	17.95
0RH/PLATE4	Alloy head plate (4-blade)	23.50
0RH/RUBS	Teeter & drag rubbers (for 2 blades)	1.30
0RH/TOP	R/H hub top moulding	2.30