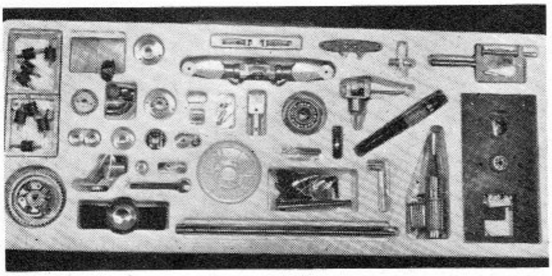
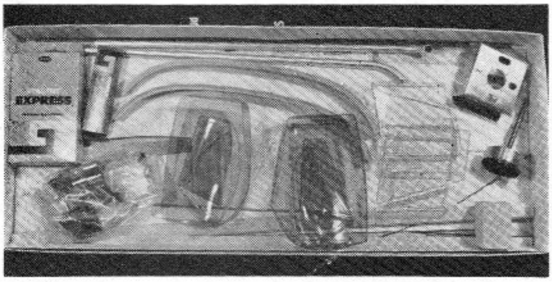
JET RANGER

built by
ROY YATES
from the
KAVAN KIT





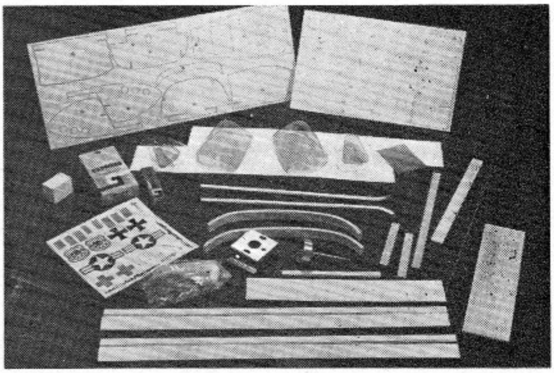
An impressive array of well finished components and hardware. Bottom photo shows the almost completed fuselage. Note the mounting fittings for the main drive mechanics.

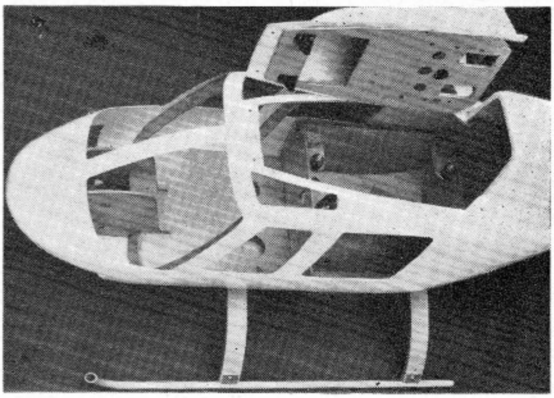
ALTHOUGH the Kavan Bell *Jet Ranger* cannot claim to be the first practical radio controlled model helicopter offered commercially in this country, it can claim to be the first to incorporate collective pitch.

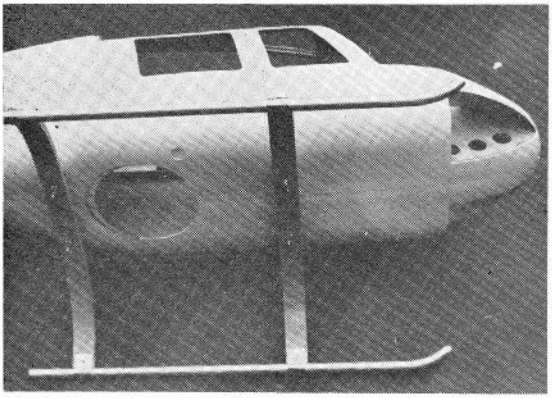
Revolutionary in its approach, the collective pitch is operated through a servo which is ganged with the motor servo. By this means, one control function on the transmitter controls, on the first half of its movement, the engine r.p.m. and, on the second half, the collective pitch. So, once the engine throttle is fully open, the collective pitch of the main rotor blades can be increased. A compensatory system is also employed on the tail pitch by a unique coupling to the collective pitch servo, that increases the incidence of the tail rotor blades as the main rotor blades' pitch increases, thereby counteracting the increased torque.

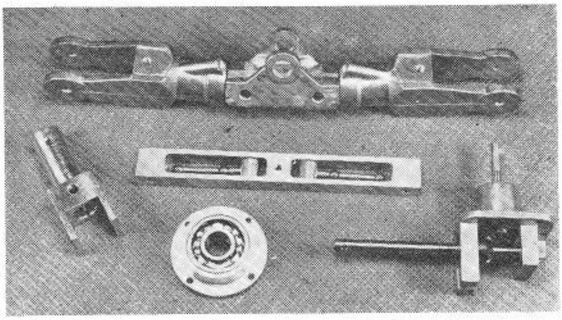
The kit comes in two parts: mechanical and airframe. Everything, apart from the fuselage is housed in a 30 × 13 × 4in. box, on which are depicted seven different colour schemes, any one of which the builder may use on the finished model. The two-part fuselage, moulded from a good quality fibreglass, is in dense white pigmentation.

All mechanical parts have been completely and accurately machined and ball races pre-assembled to casings and plates to the extend that parts neet only to be screwed, roll pinned or epoxied together. The only drilling to be done is four holes in the engine/transmission rectangular cast frames, to suit the particular engine to be installed. The motor is installed vertically, facing downwards. The original driver has to be removed, along with the split cone and replaced with one of three split cones supplied. I intend to use the HB61 (Veco) so the 8mm. cone was appropriate.









Some of the main and tail rotor component assemblies as supplied in the kit. Main rotor head shown below on its balancing jig and tail rotor hub assembly (right). Left: underside view shows fan orifice adjusted.

On fitting the tooth timing belt pulley, and the two-bladed fan having an integral male cone which is a location for the Kavan starter, the rear of the pulley tightened up on the engine crankcase. A .015in. washer between the crankshaft shoulder and the cone solved this small problem.

The action of the fan is to draw cooling air down through the fuselage, through the rectangular orifice in the transmission plate which is situated above the cylinder, and out the underside of the fuselage. The transmission plate, which sits into a plyformer frame epoxied into the fuselage, is supported by four rubber shock mounts. The reduction drive and gear are assembled to this plate, as is the bevel right-angled drive to the tail rotor assembly. The 2.555 to 1 reduction drive to the tail rotor shaft is by means of a timing belt from the engine to a 46 toothed flanged pulley that has the centrifugal clutch pre-assembled to it.

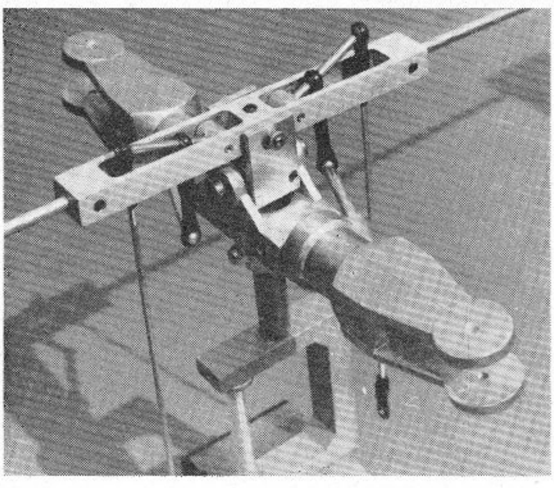
The clutch drives a friction lined drum which, on the other end of its 5in. shaft has a 16 toothed spur gear, and a common toothed bevel gear which locates with another common toothed bevel gear forming the right-angled drive. The coupling to the tail rotor bevel gear assembly, is in the form of an .080in. (14 s.w.g.) steel rod approx. 32in. long, flatted at both ends to provide the drive, and supported approximately half way along its length by a plastic tube epoxied into a plywood former.

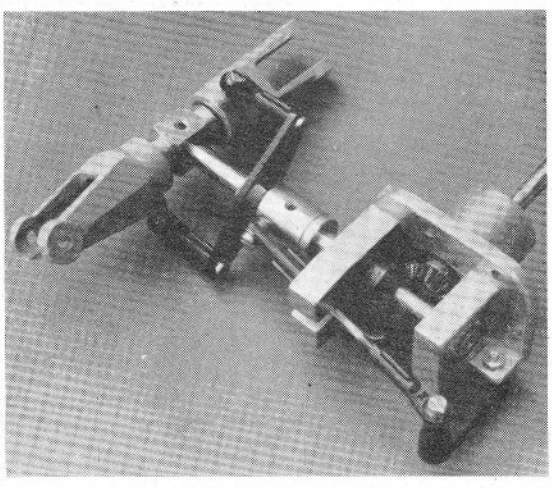
The tail rotor blade pivot head is pre-assembled, so it is a simple matter to complete the remainder of the tail unit. A right-angled bellcrank is pivoted on the underside of the bevel gear housing, which has a tapered, pillar-like boss which supports a ball joint, so bringing the pitch adjusting brush push-rod in line with a slot through which it passes, checking any tendency for it to rotate. Although, as assembled, the push-rod did pass through the slot, it did so at a slight angle. Removing a small amount from the height of the pillar gave a more parallel attitude through the slot.

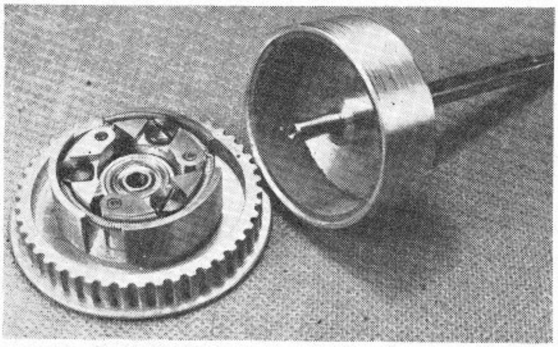
The flanged nylon control bush that connects to the blade bosses through ball links, is retained on the pitch bush sleeve by an applied fillet of Stabilit epoxy. The tail rotor blade pivot head is fitted to the drive shaft by means of a roll pin, and a centrally located 3 mm. grubscrew, locking onto the roll pin.

The main rotor shaft is assembled through and retained by the removable cabin top which, in turn, is held onto the main fuselage by four 3 mm. pan head screws. A plyformer which supports the five servos is Stabilit epoxied to the removal cabin top. This plyformer, as well as acting as the location into the fuselage top, also has the rotor head shaft main ball race bracket bolted to it. The position of this plyformer onto the cabin top, predetermines the angle at which main shaft enters the fuselage which, in turn, predetermines the angle at which the transmission base plate sits, in the fuselage, onto the engine compartment ply former fabrication.

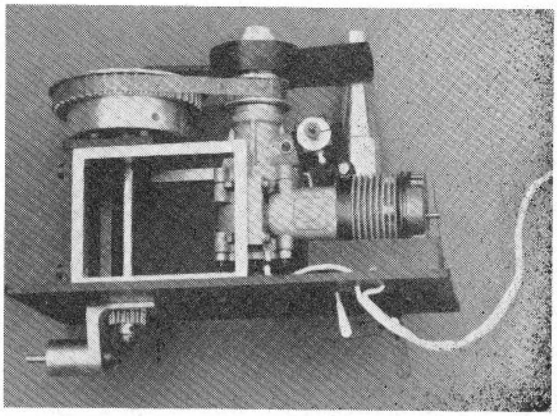
In the 30 page instruction booklet that comes with the







Sturdy clutch assembly on the layshaft. Right: motor and clutch installed with tail shaft drive unit on the main bearer plate. Bottom right: the cooling fan and swash plate assembly.



kit, it says " correct alignment, as shown on the plan, must be ensured when epoxying the tail rotor gearbox plyformer support into the rear of the fuselage." On our model there is a slight misalignment relative to the plan in the angle of the transmission base plate when *in situ* on the plyformer engine compartment. With the foregoing in mind, it is rather difficult to understand how the misalignment could have evolved and not been predetermined.

Rather concerned about this, I ran a brief test by setting the tail rotor assembly without blades onto a test bench. Supporting the shaft in a simulated misaligned position, I applied a drive by means of a pistol drill. It ran quite efficiently with no whipping tendency at all. So my concern proved to be unfounded. On final assembly it is recommended that the drive shaft to tail rotor input be epoxied into position.

The main rotor blade pivot head is in a pre-assembled stage, so the remainder of the assembly is relatively simple. A special G clamp, with attached shaft identical to the main shaft (which is primarily included for rotor head balancing) can be used to ease this assembly process. Two needle roller bearings that support the rotor blade pivot head are epoxied in position, as are two phosphor bronze bushes which act as pivot bearings for the stabilizer assembly. Two control arms which have a ball coupling end are also epoxied into the rotor blade mount. A specially shaped rubber flanged bush is inserted between the hub and the see-saw of the main blade pivot head assembly, which gives a damping effect. The two stabilizer rods are fitted into the stabilizer see-saw and retained by four pilot ended grub-screws locating in the grooved stabilizer rod ends.

Virtually all linkages and control rod couplings are in the form of brass balls and plastic universal snap-on connectors. Six of these balls are screwed to the swash plate, four on the lower plate which is already assembled to the outer race of the ball race—the biggest ball race in the kit, incidentally. Three connect to the servos through their corresponding linkages, while the fourth acts as the swash plate fulcrum. The remaining two are screwed to the upper plate which is pre-assembled to the upper race, and these connect to the control rods going to the main rotor head stabilizer see-saw compensating arms. The collective pitch movement is allowed by a ball joint located in the centre of the upper swash plate which allows the complete swash plate assembly to slide up and down the main rotor shaft.

The fuselage construction is very straight forward, with only a small amount of trimming required. The biggest job was cutting out the large window areas which, with a fibreglass construction, I imagined would be a little delicate. The fuselage however, is of a very resilient quality and stood up to the manhandling with no sign of a crack or fracture. Particular attention has to be paid to the squareness of the engine compartment plyformer fabrication when gluing, and also to chamfering off the plyformers where marked with dotted lines.

A slight discrepancy on the nose plyformer fabrication, which is not evident on the plan, is the position marked for former 8a on former 8. However, by studying the plan, one can see what is required. Having installed the engine compartment ply fabrication by lining it up with the aid of the cabin top and main shaft, the engine and transmission plate assembly is used to position the cut-out in the fuselage underside.

The two blade fan has to be a 1 mm. clearance fit into this orifice, and the instructions advise that a 20 mm. × 1 mm. plywood skirt should be epoxied to the inside of fuselage and sit flush around the opening. This, they say, will improve the efficiency of the fan. There is already a precut hole in the fuselage for this purpose, which the manufacturers have deliberately left on the small side. I found that the hole in this particular one was very slightly out of position. It was little trouble to perform a slight patching operation, however, at the same time that the skirt was fibreglass reinforced.

Very little filling was required on the fuselage surface; in fact, so good was the dense white surface, that I was very tempted to use the all white and red line trim colour scheme shown on the lid, thereby saving myself a painting operation. However, after seeing one of the main agents demo models colour scheme at Kidlington, I fell hook, line and sinker, so the registration on my finished model will be G-BAKF.

To be continued