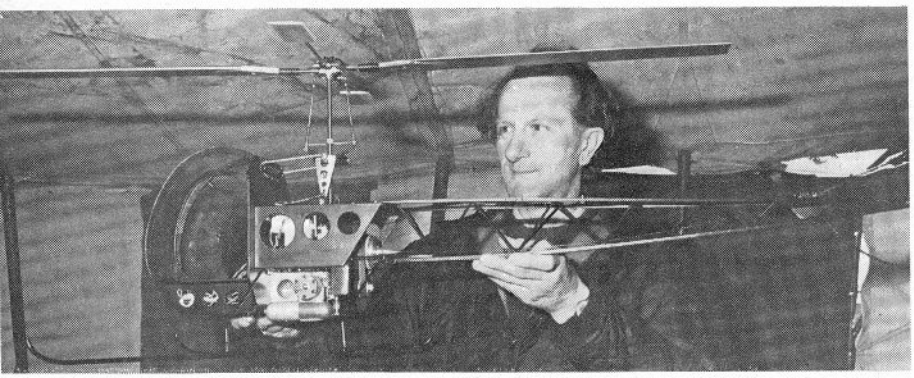


The Morley Mark II B R/C Helicopter

WINNING the Sywell home-built 'copter contest was a pleasant reward for many hours of effort. My mark II B helicopter is the rebuild of a design intended to be as simple as possible while still of near scale appearance. It follows a number of torque reaction types, some of which I think were better than appeared at the time due to pilot troubles.

The original mark II showed promise but was extremely skittish, with control lag and control backlash it didn't fly far. The II B then is of more rigid construction, slightly changed mechanical layout and very different servo positions to simplify linkage.

The biggest problem in the design was to achieve a tidy way of controlling collective pitch without a mass of complicated machinery, and also a way of controlling five functions with four servos. I considered collective pitch essential for positive take off and landing, particularly with a smaller powered model.

The airframe is simply a plywood vertical bulkhead at the back of the pilot, with a platform going forward and two checks going rearwards. The platform has a box under for radio and a light frame above for the bubble. The checks enclose the works with the landing gear below and the spruce tail extending behind.

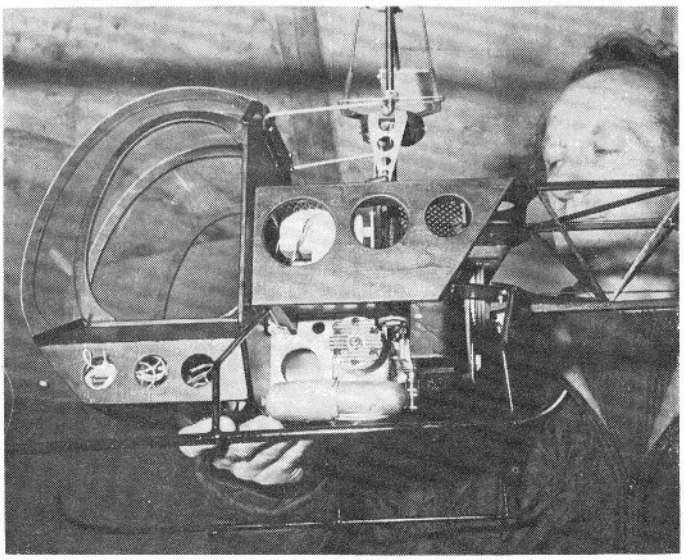
Engine and Rotor drives

The O.S.40 engine is mounted on its side directly below the rotor shaft. This gives easy access to the glow plug and the rearward pointing crankshaft is accessible for the electric starter.

Fan cooling is provided by a turned down impeller from a vacuum cleaner clamped behind the toothed belt pulley on the crankshaft. A casing ensures that the air is drawn past the crankcase and then onto the cylinder.

That assembly, with a fuel tank, is below the main chassis plate and a bearing block on this support a large pulley with built-in clutch driving forward to the main rotor levels and rearward to the tail rotor. The tail rotor is thus 15/32 of engine speed and the main rotor at 8.5 to 1.

An 18 s.w.g. wire supported in short pieces of P.T.F.E. transmits the power to the 1:1 bevel drive of the tail rotor. It was failure of the tail unit which finally caused the rebuild and prompted me to make a purpose-built nylon moulded gearbox for the II B.



Control System

This is best understood by studying the appropriate sketch. The throttle is worked in conjunction with the main rotor collective pitch using an M.F.A. servo saver, which must have been designed for the job!

The throttle is closed at negative incidence, full open at zero and remaining so for all positive incidences. Thus in theory you can auto rotate on engine failure, though all efforts so far have been to get up and stable without thinking too far ahead.

My argument, right or wrong, is that with the engine flat out at all times the torque is more or less constant and the tail rotor control has only to be trimmed to compensate for its own change of revs with drag change of the main rotor; and that this is better than the swing problems with a throttle controlled main rotor.

The swash plate is unusual in that it has a double gimbal and is raised and lowered complete in a cradle by the collective pitch servo. The two cyclic pitch servos thus have to have a linkage that couples with interaction from collective pitch operation.

The rotor head is unusual also in that the blade pitch axis is offset from the rotor shaft centre to enable the push rods from the swash plate to the rotor control bar to be normal to this. The control bar has a hump in it to clear the axis block and located by swivel bearings on trailing control arms from the rotor blades. The length of these arms has no effect on the cyclic pitch control but decides the sensitivity of collective pitch control.

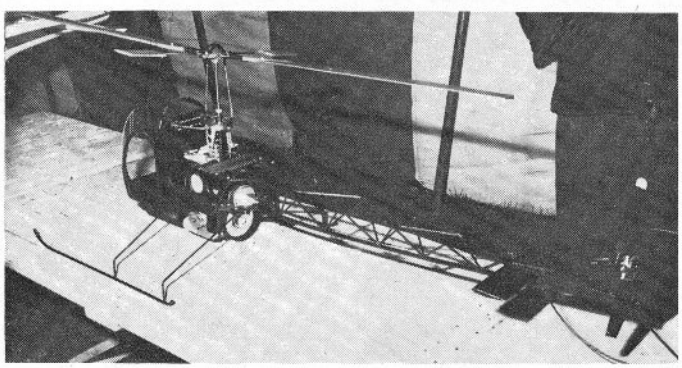
Instead of radial and flapping hinges the rotor blades are mounted on piano wire. It seemed that 10 s.w.g. was better than 8 s.w.g. though it is in this area that all the experimenting and development hours must be spent. Obviously blade stiffness, weight, aerofoil section, rotor speed, diameter, servo action and I think dozens of other variables all have an effect on control and need to be sorted out.

Test flights so far have indicated the need for cat-like reactions which may be replaceable by experience. We'll see. I think the next stage is the making of a ball-race rotor head of the same layout to see if this improves things.

If any experimenters wish to take a small short cut I will shortly be able to supply the tail rotor gearbox and possibly toothed belts, gears etc.

S.A.E. with requirements to:- J. Morley, 403 Woodham Lane, Woodham, Weybridge, Surrey.

Left: front fuselage area of Morley Mark IIB helicopter showing the drive assembly mechanics, while below is a general view of the model srowing the Bell 47 style layout.



Winner of the Sywell Helicopter Contest describes his model

by
J. M. Morley