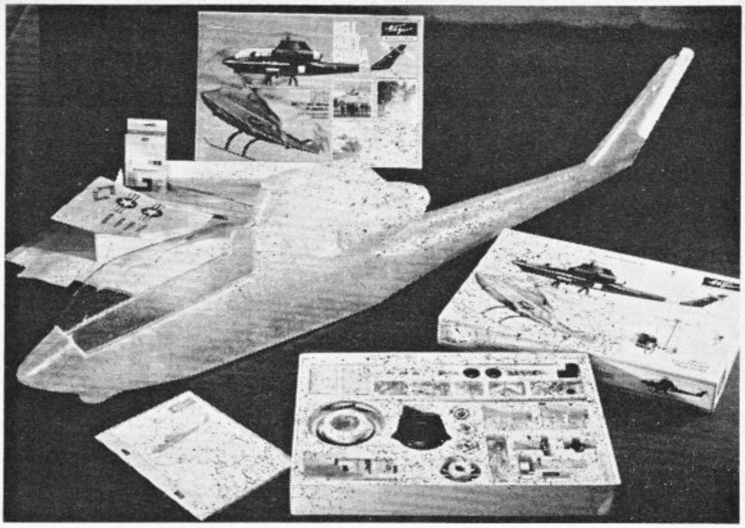
building the

SCHUCO-HEGI

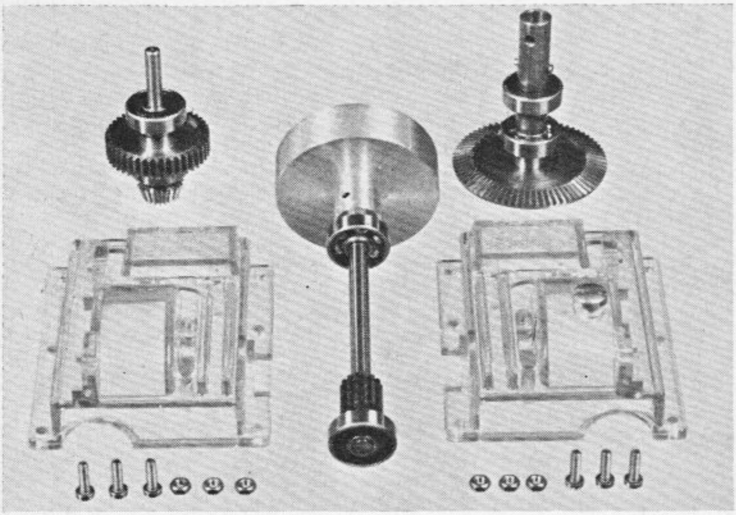
COBRA

HELICOPTER

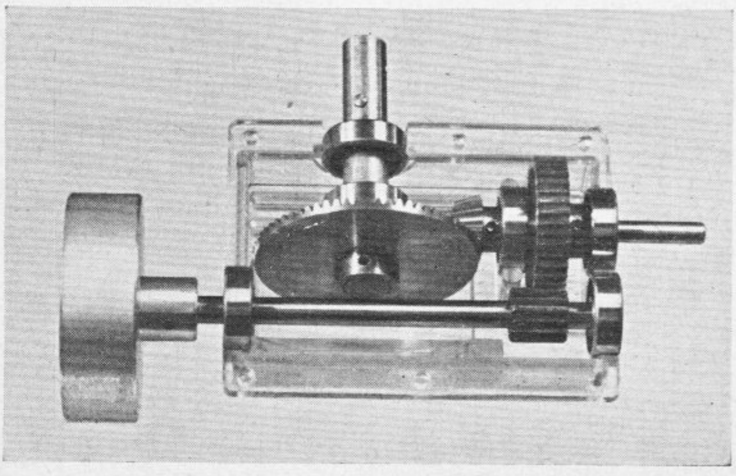
—— Part I ——



TONY BRAY reports on progress to date on the R.M. review kit from Ripmax



Gearbox components, above, and partly assembled below. In lower photo, clutch is extreme left, main drive to rotor head is at top and tail rotor drive, via 3:1 spur reduction gear, on right. Ball races extremely good fit in gearbox casing, which is moulded from very tough transparent plastic.



THIS model, designed by German Dieter Schlüter, and produced by Schuco-Hegi, is distributed in the U.K. by Ripmax Ltd. and is the first practical radio controlled helicopter to be offered commercially. Schlüter started to make a radio controlled helicopter in 1967 and, with no model information available, it was not until 1969 that the rotor system used today reached a practical stage of development. In January 1970 the first fully controlled flights were made, and in March the first Bell-Huey *Cobra* was ready to fly. Development continued and in June Dieter Schlüter made a world record flight of 27 mins. 51 sec.

In response to many requests Dieter Schlüter first produced kits himself, but problems of mass production led to the association with Schuco-Hegi and the production of the kit in its present form. The kit was reviewed in December's RADIO MODELLER and is in two parts, mechanical assemblies and airframe. For purposes of description the mechanical kit will be dealt with first. This kit is complete to the last nut and bolt. All parts are accurately machined where necessary and, apart from deburring and drilling four holes in the nylon tail rotor gear box, no work, other than assembly is required.

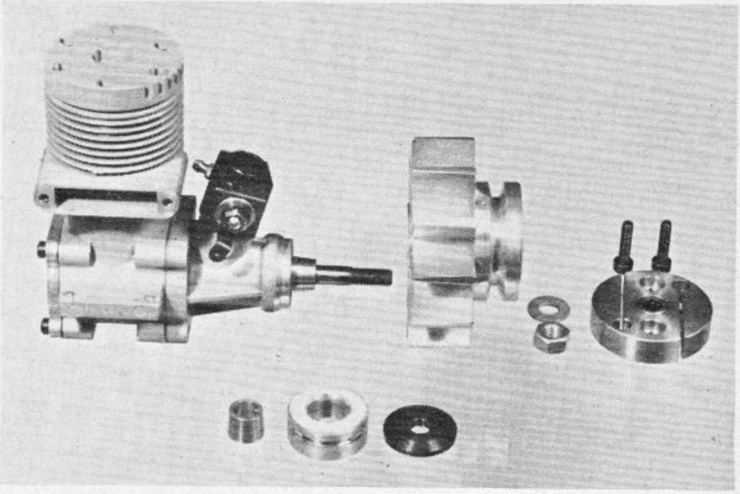
The recommended motor is the Veco 61, but the Veco silencer is not suitable as it is not sufficiently off-set to clear the fuselage and extension pieces are not available. Other motors may be used, but easy starting and reliable slow running are essential. The motor drives the main gearbox via a centrifugal clutch and is cooled by a large radial fan. To fit this fan and clutch it is necessary to remove the propeller drive collar from the motor and replace it with a split tapered brass bush which mates with the aluminium fan. The fan is driven onto the motor shaft with the propeller nut and the split bush locks it securely. The centrifugal clutch plate is bolted to the fan with two socket cap screws, and it is the mass of this assembly which provides the necessary fly-wheel effect for the satisfactory slow running of the motor.

The clutch plate drives an aluminium drum which is lined with "Ferodo" type material and is so designed that the clutch is fully engaged at 3,500 r.p.m. This drum is mounted on the first motion shaft of the gearbox and drives the tail rotor shaft through a 3:1 spur reduction gear. The drive for the main rotor is by a 7:2 bevel reduction from the tail rotor spindle. Thus the main rotor rotates at 2/21 times the engine r.p.m. The gears are all cleanly machined from steel and each shaft runs in two ball races, the outer bearings having integral oil seals.

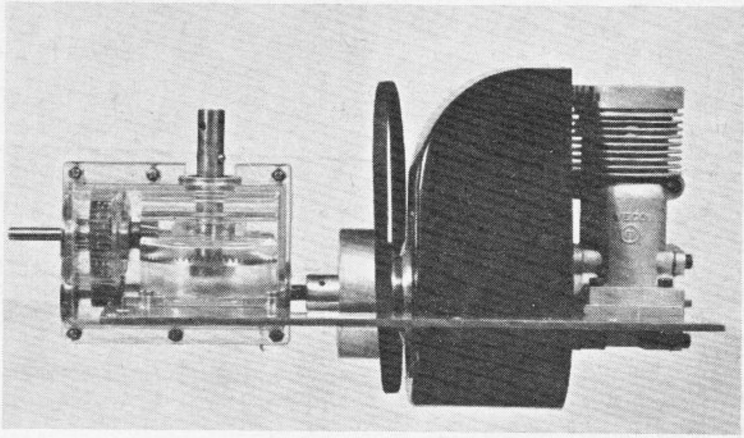
The six ball bearings and all the gears are pre-assembled on the shafts and the gearbox case, which is moulded from a very rigid transparent plastic, is accurately machined on its mating faces and in the bores for the bearings. The case is split along its centre line and the bearings are first glued into one half of the box with Stabilit Express epoxy adhesive. When this has set and the mesh of the gears has been checked, the two halves of the box are glued and bolted together. This method of construction is unusual, but it produces a strong, light gearbox in which, because it is transparent, the oil-level is easily checked.

The power for the tail rotor is transmitted by a flexible steel shaft 5 mm. diameter running in a thin brass tube. The 90° gearbox has a 1:1 steel bevel drive and is housed in a nylon case. The gears and bearings are again pre-assembled and have only to be fitted into the case. When the correct mesh is obtained they are secured with self-tapping screws. The pitch control rod for this rotor passes through the rotor shaft, and is moved axially by an angled slot in a bracket bolted to the right hand side of the fin. It is necessary to file this slot so that the rod will move easily from end to end but be free from "back-lash."

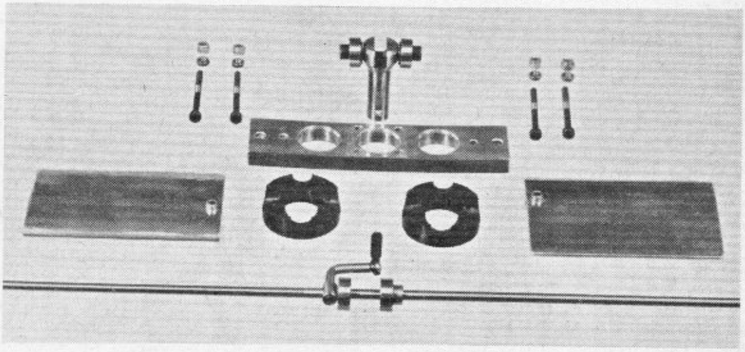
The main rotor shaft is coupled to the gearbox by a steel sleeve and is located by a ball bearing on top



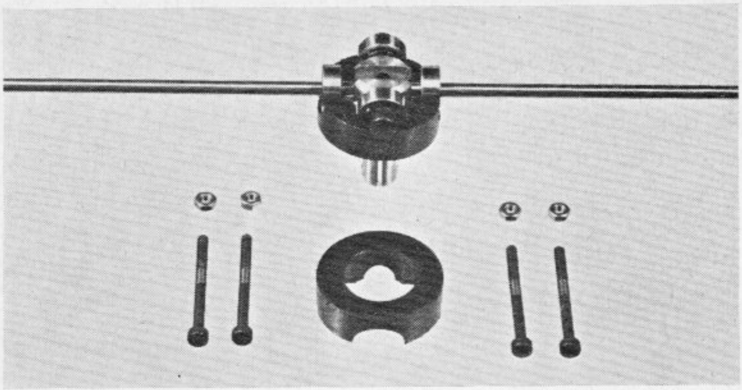
Veco 61 shown here with standard prop driver parts removed (foreground) and fitted with split tapered brass bush which fits into the aluminium fan (machined from solid). Clutch is seen on right.



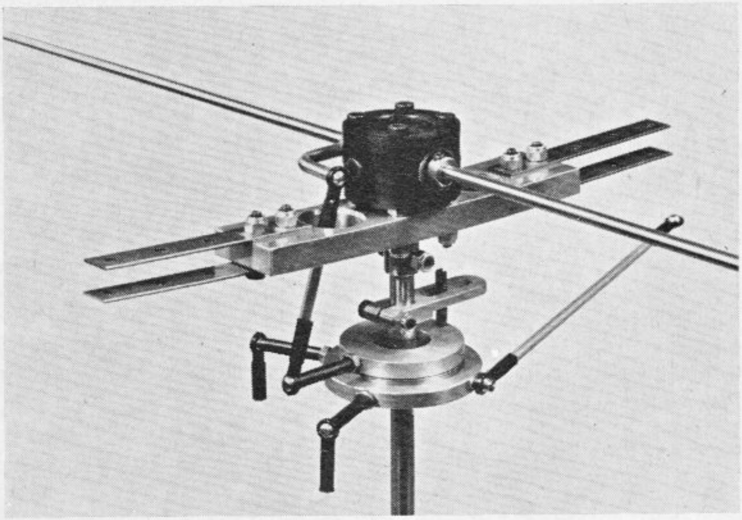
Assembled gearbox, clutch and motor mounted on dural bearer plates with cooling duct over fan, starter ring in place. Below: components for rotor head assembly.



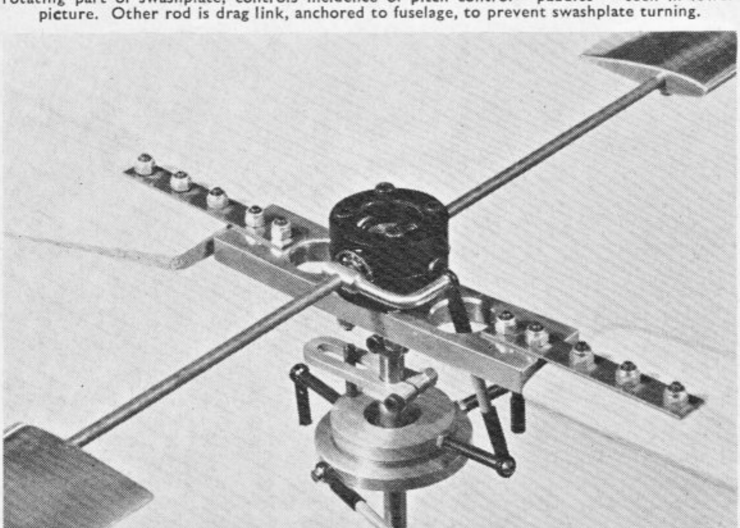
of the fuselage. It then passes through the swashplate assembly to the rotor head. The swashplate is, in fact, two aluminium plates fixed together by a ball race so that one, the lower, may be prevented from rotating by a link connected to the fuselage, while the other is rotated at rotor speed by a link clamped to the rotor shaft. Both plates are located on the shaft by a balljoint so that they are free to



Ballraces form gimbal in bearings head.



In these close-ups, the two unconnected links go to servos, to tilt the swashplate. Link from rotating part of swashplate, controls incidence of pitch control "paddles"—seen in lower picture. Other rod is drag link, anchored to fuselage, to prevent swashplate turning.



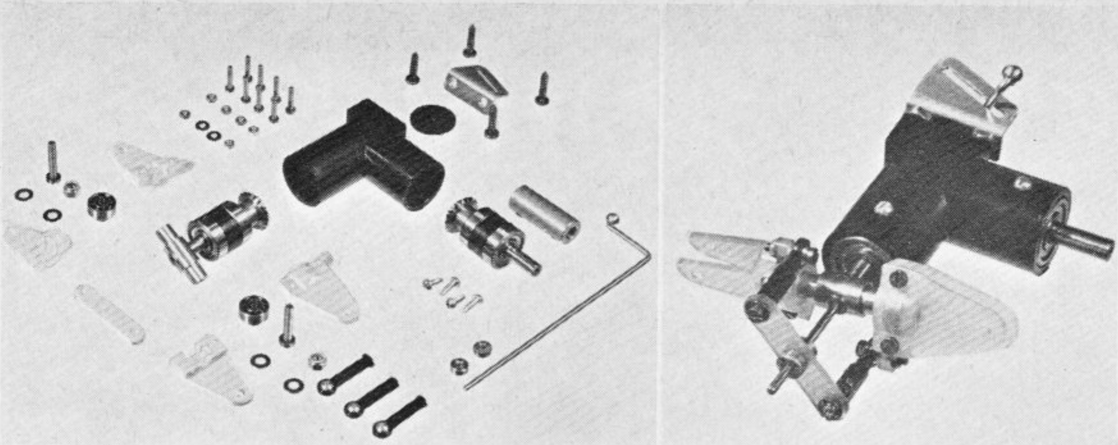
tilt in all directions. The lower plate is connected by links at 90° to two servos and the upper plate to the rotor by a single link to control the cyclic pitch. The swash plate is pre-assembled and it is only necessary to fit the arms and linkage.

The rotor head is the most complicated part of the aircraft and, because of the big loads generated by centrifugal force, great care in assembly and balancing is essential. Dieter Schlüter notes in the instructions that at full rotor r.p.m. the tips of the blades are travelling at 400 Km. per hour (250 m.p.h.) and the centrifugal force on each blade is 60 Kg. (1 cwt. 20lb.).

The rotor has two functions, to provide lift to support the model and to provide a horizontal force to produce forward or sideways flight. In full size practice it is usual to control the lift by changing the incidence of the rotor blades. This is called collective pitch control. When the pitch is increased, the power required to maintain rotor speed is also increased, so the throttle needs adjustment. With this increase of power the tendency for the machine to rotate about the rotor shaft increases, and the pitch of the tail rotor blades has to be adjusted to compensate. Thus, a simple change of lift requires the adjustment of three controls. However, the system used in the model is far more simple. To increase the lift the speed of the main rotor is increased. This, of course, increases the power absorbed and the tendency for the machine to rotate about the rotor shaft but, because the tail rotor is geared directly to the main rotor, its speed, and thus its thrust, also increases. Careful design of the rotors of the Bell-Huey *Cobra* has produced a balanced system and the throttle can be opened or closed without the model rotating.

If the rotor head rotates in a horizontal plane only lift will be developed. If, however, the rotor head is effectively tilted, then a horizontal as well as vertical force will develop and the machine will accelerate in the direction of the tilt. This tilt may be in a direction to produce forwards, sideways or backwards flight. The tilting of the main rotor of the Bell-Huey *Cobra* is by cyclic pitch control.

The two rotor blades are rigidly connected to the main rotor hub and, in the neutral position, each blade has a positive incidence of 4°. However, the hub can rock about the blade axis and increase the incidence of one blade and decrease



The tail rotor gearbox showing the parts and assembled unit.

that of the other. For example, if the hub is rocked 1° the incidence of one blade will be increased to 5° and the other decreased to 3° but the sum of the two will still be 8° and the sum of the blade resistance and, therefore, the resulting torque will be constant. However, the blade with the most incidence will have the most lift and will rise. Conversely the other blade will fall. As this rocking is controlled cyclically, each blade will rise at the same point in its rotation and effectively tilt the rotor head. The rocking is controlled by a stabilizer bar which has two small but relatively heavy stabilizers. These are solid aluminium castings of symmetrical aerofoil section. The incidence of these stabilizers is controlled by the swashplate and, in a neutral condition, the stabilizers rotate in a horizontal plane and have the effect of a gyroscope. In this condition both main rotor blades have equal pitch and will produce pure lift. Now, if the swashplate is tilted, the stabilizer bar will rotate and one stabilizer will have positive incidence and the other negative. The stabilizer with the positive incidence will rise and the one with negative incidence will fall. This will tilt the rotor hub and control the pitch of the main rotor blades.

The stabilizer bar and the main rotor are mounted on ball bearings housed in a nylon gimbal. This is bolted rigidly to an aluminium hub to which the blades are connected with steel straps.

The main rotor blades are constructed with beech leading edges and balsa trailing edges. The profile is machined to a Clark Y section and the holes for the fixing straps are pre-drilled. (It is as well to check that both blades are of equal thickness as, in the review kit, one blade was 1 mm. thicker than the other and had to be reduced with coarse sandpaper.) The main rotor blades should be sanded to a fine finish and the roots, where they are fixed to the rotor hub, and the tips, should be filled and finished with polyurethane lacquer. The parallel sections can then be covered with the heavy self-adhesive film supplied.

The tail rotor blades, which are constructed with a balsa leading and trailing edge joined by a spruce spar should be treated in a similar manner.

Next month we will describe the balancing of these blade units, together with the details of the fuselage construction and, weather permitting, a flying report.