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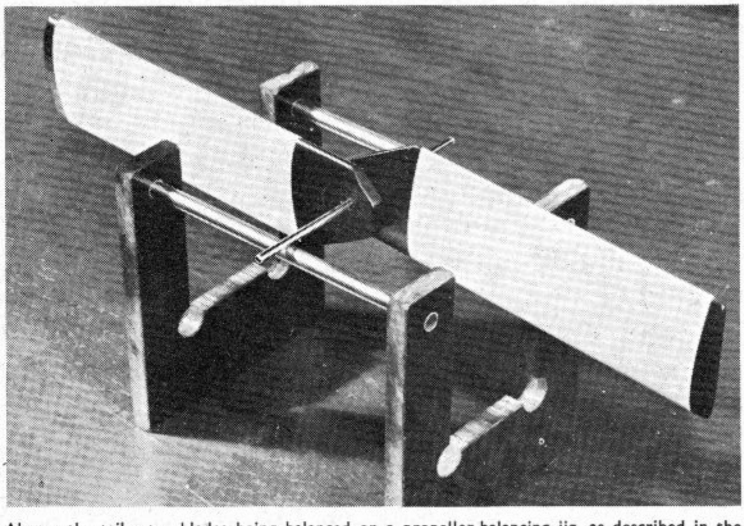
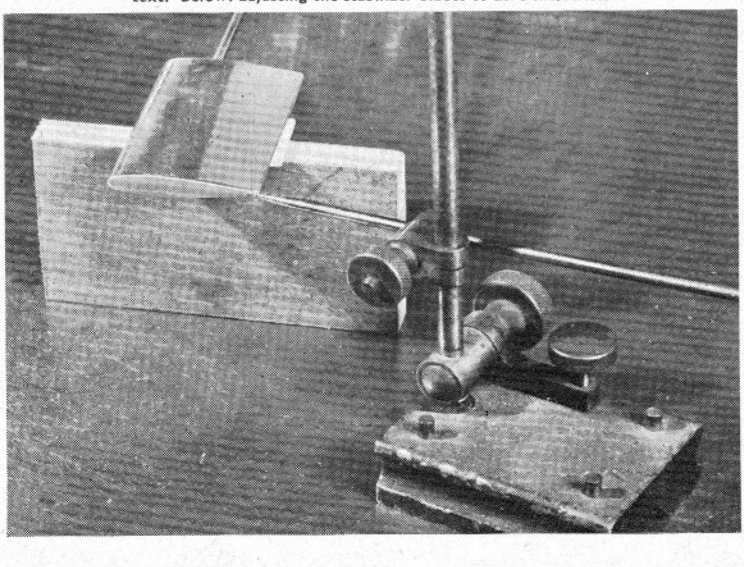
TONY BRAY descr
review model—now



Above: the tail-rotor blades being balanced on a propeller-balancing jig, as described in the text. Below: adjusting the stabilizer blades to zero incidence.



LAST MONTH the assembly of the mechanical units and the finishing of the main and tail rotor blades was described. If the blades are now balanced and set up on their hubs it will complete these units.

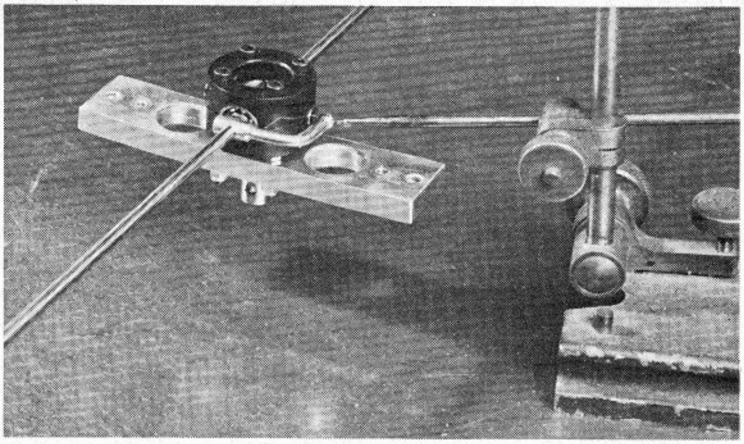
The tail rotor blades may be balanced using a conventional propeller balancing fixture. They are mounted on a spindle that is a tight push fit in the fixing holes. The blades should be adjusted so that their axes are in a straight line. This is important, as any misalignment (e.g. so that the blades form a flat "V") will cause them to be stable during static balancing, and mask any imbalance. Any gross error is best rectified by drilling and tapping a 2 BA hole down the end of the hard wood spar of the light blade. 2 BA grub screws can then be glued in the hole until approximate balance is obtained. Fine balance is achieved either by drilling a lightening hole in the end of the heavy blade, or adding a self-adhesive tape band to the tip of the light blade.

The first step in setting up the rotor head is to align, roughly, the stabilizers on their connecting bar. This bar can then be slid through the gimbal head until the stabilizers balance. It is clamped in this position by a collar on one side of the gimbal and the incidence control arm on the other. The stabilizer blades now have to be adjusted so that they have zero incidence. If the blades are rested on two wood blocks of equal height, and the trailing edge of one blade is packed up so that its centre line is horizontal,

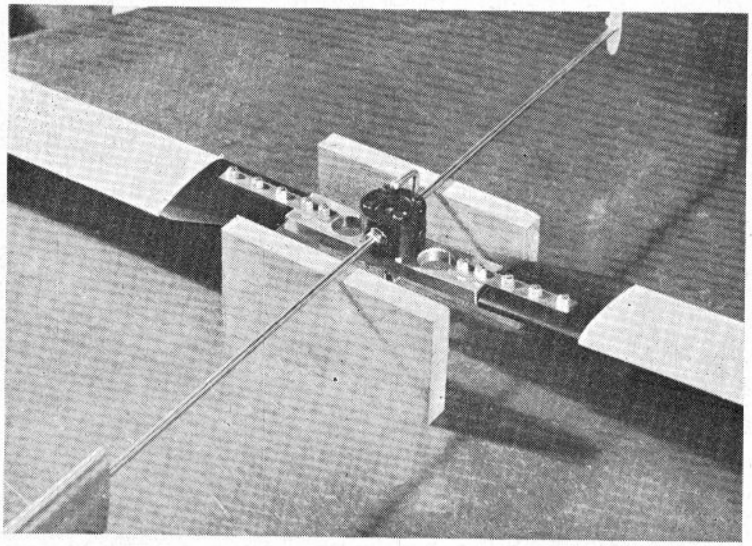
building the Bell-Huey "COBRA" HELICOPTER from the Schuco-Hegi kit

— PART TWO —

cribes completion of the R.M.
w ready for learning to fly !



Above: adjusting the incidence control lever so that the ball is on the same centre-line as the stabilizer blades. Below: the balance of the main rotor being tested by resting the stabilizer bars on blocks.



the other blade can be rotated until its centre line also is horizontal. The blades are then clamped to the bar and, while the blades are set up like this, the incidence control lever can be adjusted so that the ball is on the same centre line. These settings are most conveniently made using a scribing block as shown in the photographs but, if such a tool is not available, they can be made by measurement, using a steel rule.

The main rotor blades are now bolted to the hub and, with the stabilizer bar resting on the wood blocks, their balance may be tested. Again, rough balance should be achieved by drilling and tapping the hardwood leading edge of the light blade and adding 2 BA grub screws. Final balance can be achieved by adding different coloured tapes to the ends of each blade but adding more tape to the one which is light. These coloured bands can be used later to check that both blade tips rotate in the same plane.

The final adjustment is to align the axis of the blades so that the complete assembly again balances in the gimbal head. One hole in each side of the hub is drilled oversize to allow this adjustment. This setting up procedure sounds complicated but is, in fact, very easily accomplished in under 15 minutes.

The air-frame kit includes the fuselage moulding, all wood required, acetate canopy, preformed laminated arches and bent aluminium tubes for the semi-scale landing skids, together with wood and hardware for the training undercarriage. The only parts the constructor has to provide are wheels, fuel tank, short pushrods for the swashplate and throttle and, of course, the radio and engine.

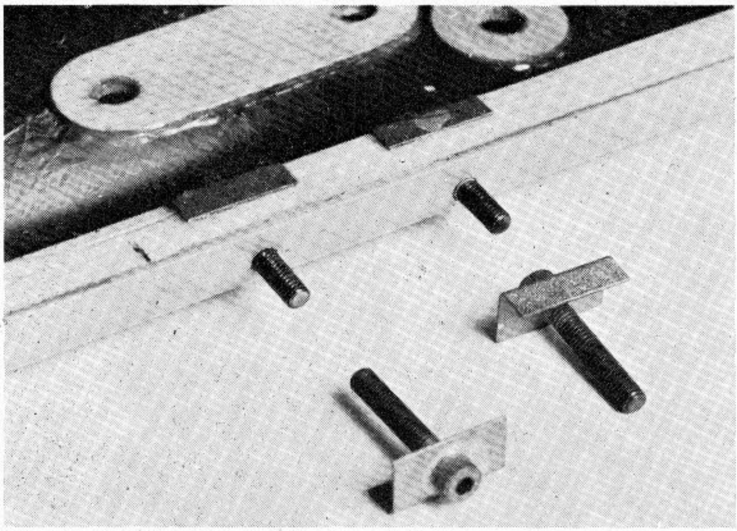
The moulding for the fuselage, which also incorporates the fin, is produced in glass-fibre reinforced polyester resin and, although it is almost six feet long, it only weighs 31oz. The front section of this moulding is reinforced with five bulkheads and six longerons. All the bulkheads are die cut from $1\frac{1}{2}$ mm. five-ply and require very little trimming to fit. Four of the longerons are balsa and two are spruce. The latter are epoxied to the inside of the bottom of the fuselage, to provide a base for the engine/gearbox assembly. The four balsa longerons stiffen the flat sides of the fuselage.

The motor and gearbox assembly is fixed to the base of the fuselage with eight bolts. It is most convenient if these bolts are captive in the hard wood rails. A satisfactory way of achieving this is shown in the photographs. Small angle brackets about $\frac{3}{8}$in. long are made from thin steel (case strapping is ideal) and are soldered to the screws as shown. These can then be epoxied to the wood rails. (*Photo overleaf*).

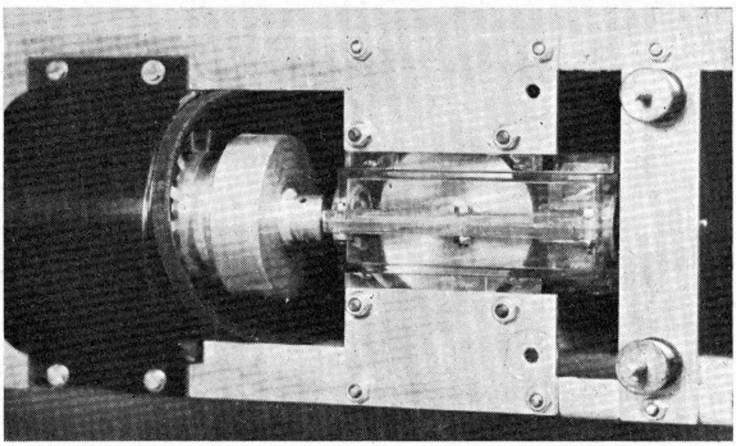
All holes that are cut in the fibreglass shell, should be reinforced with plywood patches. This adds very little weight to the machine, but stops fatigue cracks developing in the shell.

A thin-wall brass tube has to be bent to the shape shown on the plan, and fixed to the fuselage with epoxy and glass cloth, to carry the flexible shaft for the tail rotor drive. This tube has to be carefully positioned to align accurately with the tail rotor gearbox at one end, and the main gearbox at the other. A small diameter nylon tube is fixed in a similar manner to carry the push-rod for the tail rotor pitch adjustment.

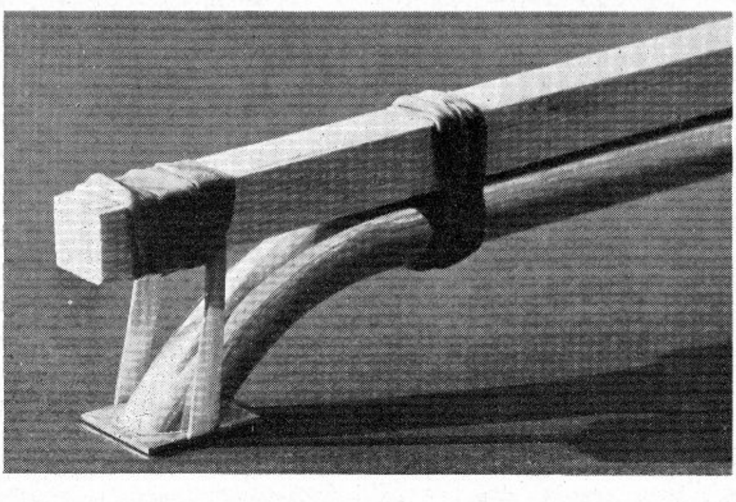
After fixing these tubes the open



Tony made these captive-bolts for fixing the engine/gearbox assembly to the fuselage. Eight of these are used. Note ply reinforcing patches added where holes are drilled.



Above: modification—instead of bolting the undercarriage to the gearbox plate, a separate light alloy strip was added (right) to take landing loads. Below: an added touch—ends of landing gear tubes blanked off—shown here being held while epoxy is drying.



trailing edge and top of the fin are filled with balsa blocks and sanded to a streamline shape. Two slots have to be cut in the rear section of the fuselage for a stabilizer, which is supplied ready cut from 1 mm. plywood.

The canopy is an acetate moulding and can either be cemented to a simple balsa frame, or built into a fully detailed scale cockpit. However, in the latter case, some research is required as no detailed information is included on the plan.

The fuselage and canopy frame can be finished in either polyurethane or cellulose, with a clear polyurethane top coat to make it fuel-proof, but whichever finish is used we recommend the same preparation. The shell should be washed with detergent, then wiped with a solvent-damped cloth to remove all mould release agent. It should then be lightly sanded with 320 grit "wet and dry" paper. All sanding dust should be brushed off and, if possible, blown from any holes. A coat of thick primer should then be virogously brushed on, when this is dry it should all be sanded off back to the fibreglass. This may seem to be wasteful, but the purpose of this coat is to fill all the small holes and porosity in the surface, and this method is much quicker than individually "stopping" each hole. It may be necessary to repeat this filler coat in places where the porosity is bad. When all the holes are filled, the shell may be finished by brushing or spraying, the latter is, of course, both quicker and more satisfactory.

The semi-scale landing skids consist of two laminated wood arches, which require sanding and painting, and two pre-formed aluminium tubes. The tubes are fitted to the arches with aluminium clips. The material is supplied for these, but they have to be formed and drilled. The appearance of the tubular skids can be improved by blocking the ends. This is easily done by sticking aluminium discs to them with epoxy adhesive and then filing these to shape, finally polishing both the end caps and the tubes.

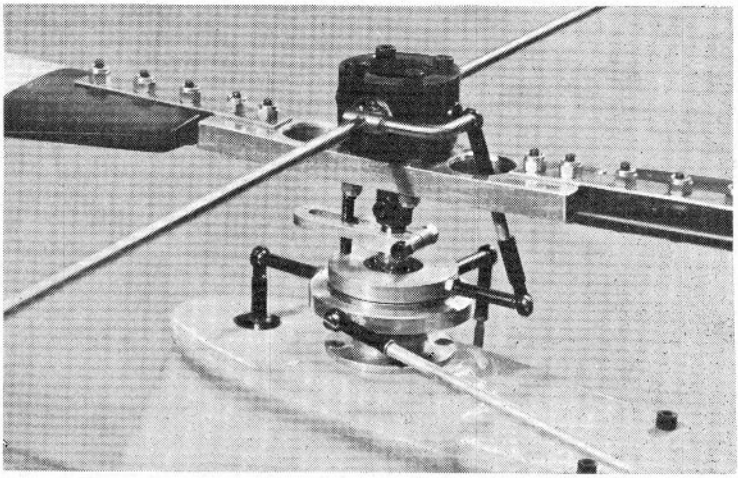
The arches are fitted to the engine/gearbox chassis with four flexible rubber buffers, and here a modification is strongly advised. The two chassis plates are joined at one end by the motor, and at the other by the gearbox. However, as the gearbox is plastic, it is not considered sufficiently strong to bear added stress due to heavy landings. It is suggested that a separate light alloy strip $4\frac{3}{8} \times 1 \times \frac{1}{8}$in. is bolted across the fuselage shell, to the hardwood rails, to carry the rear rubbers and relieve the gearbox of any added stress.

The skids are only 14½in. wide and the model is 23in. high, thus they do not provide a very stable base for "tyro landings." Schlüter recommends that all beginners to helicopter flying—and that's just about everybody—uses a trainer landing gear. This consists of a separate nose leg, which extends forward 10in. in front of the nose and two triangulated side frames made from 12 mm. square spruce. The two lower legs of the frame are attached to the rubber buffers provided for the skids, and the third to a bracket bolted to the top of the fuselage to the rear of the swashplate. This arm is sprung, which helps to reduce shock.

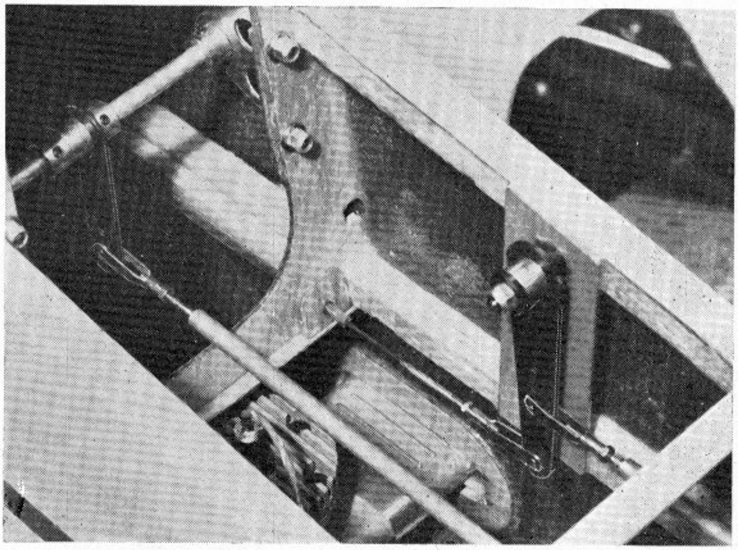
The plan shows non-castoring wheels, but Mick Charles, who was one of the first to complete a Bell-Huey *Cobra* kit, recommends that these wheels be replaced with castoring nose-legs, so that landings which are "yawed," will not result in the model tipping over and damaging the rotor head. This modification has been incorporated in our review model, and will be described more fully in the flying report.

The c.g. of the model should lie on the centre line of the rotor shaft and, to obtain this without extra weight being added to the nose, it is necessary to install the radio, battery and servos as far forward as possible. The Deac and receiver can be mounted in foam rubber forward of the first bulkhead while, in the review model, we mounted three servos, two for the swashplate and the tail rotor pitch control, high up in the fuselage under the canopy floor and the engine servo on a separate tray with the switch directly below. If a detailed cockpit is contemplated, then the floor has to be lowered and the three servos will have to be mounted lower in the fuselage.

The control rod travel at the swashplate balljoints and tail rotor pitch control balljoint, should be 20/24 mm. If rotary servos are used, it should be possible to extend the arms or discs to give the movement required. However, if linear servos are used, it is necessary to provide some amplification. In the case of the swashplate, this may be done by using bellcranks with arms of unequal length but, for the tail rotor control, a straight lever with the input at a shorter radius than the output is required. The arrangement used in the review model is shown in the photograph.



The completed rotor-head is secured to the main drive shaft by a single bolt. All control-rods are fitted with ball-and-socket ends. Below: some "engineering" not in the kit—Tony made these bell-crank assemblies to adjust the throw from the Futaba linear output servos used. Also, he made the extension for the Veco 61's silencer, to bring it clear of the fuselage side.



The aerial must be brought out through the nose and allowed to hang loose. It should not, under any circumstances, be rooted along the fuselage, as there are so many "metal-to-metal" parts, that glitching will undoubtedly occur.

The object of this report has not been to describe the construction of the kit in great detail, but to give the prospective builder some idea of the work involved. The kit, which consists of over three hundred and fifty parts, can easily be built into a very impressive model. It is a pleasure to build, as all the mechanical parts are accurately machined where necessary, and fit without trouble. All holes are correctly positioned and no "drawing" or "opening-up" is necessary. The die-cut wood parts are clean and accurate and all materials are of first class quality. The full-size plan is most explicit, and the instructions, which are in the form of a forty-page manual, include both a primary and advanced flying tutor.

Over five years of development by a qualified engineer, have gone into this model to produce the simplest and most stable control possible. It must represent the finest introduction to radio-controlled helicopter flying which will be available for many years.