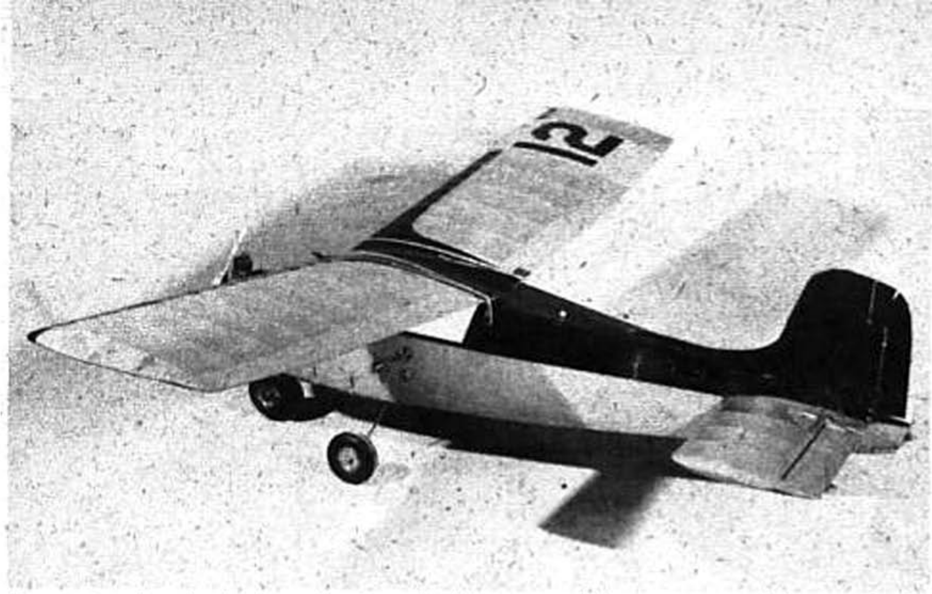
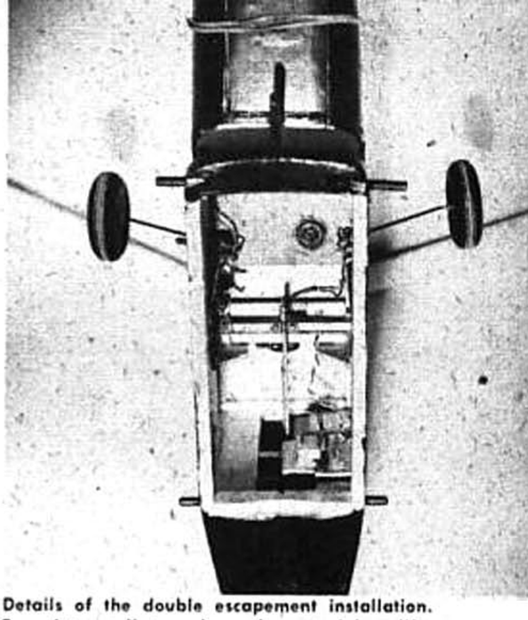


Rear quarter view clearly shows elevator and rudder areas and the arrangement of the control rods. Pins on both surfaces may be moved to alter movement. Wheels are barely behind CG position.



Details of the double escapement installation. Two intermediates give adequate juice, life.

high diver

Any desirable characteristics result from experiments with NACA 2412 airfoil. For flying either rudder only, or with elevators, stunting improved.

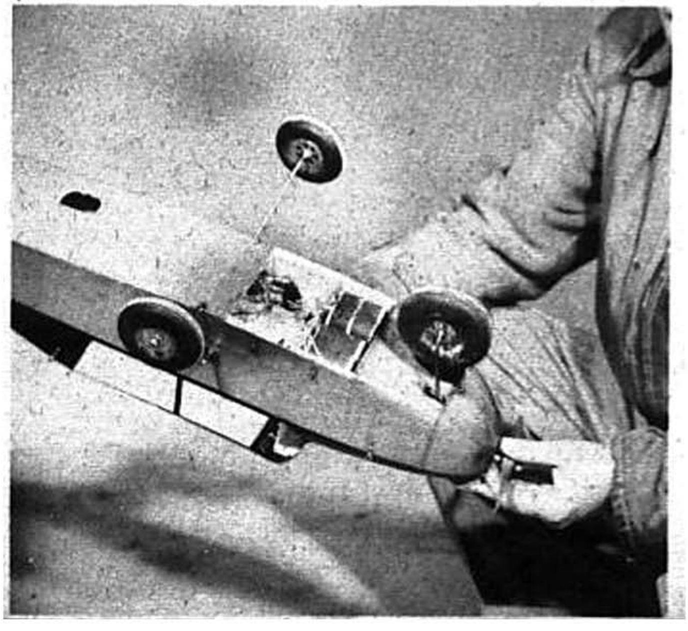
▶ After deBolt's experiments with the full symmetrical airfoil and short coupling, à là the U-control stunt, the High Diver was begun as a more moderate experiment, using convex undercamber (NACA 2412 airfoil) in combination with both rudder and elevator. Not only did results warrant this plan, but a number of interesting possibilities were revealed.

The elimination of ballooning is, perhaps, the most important. The minimum airplane that would incorporate sufficient structural strength to survive anticipated air loads imposed by violent pull-outs, and, perhaps, inverted maneuvers, carrying two escapements and a really reliable complement of batteries, appeared to be approximately 3-3/4 lb. gross (spun in on dirt, it broke a prop), which, at about 18 oz. per square foot of area, works out to a little under 5-ft. span. To gain area without excessive span, an aspect ratio of about 5-3/4 to 1 was employed. The combination of airfoil selected and rather high weight meant a fast moving ship during elevator maneuvers, so moderate power, a K & B .15, was called for. A .19 would be murder on a small fast ship using flippers that really react, but will go nicely in a rudder-only version where high performance is desired. A 9 x 6 Power Prop allowed the .15 to rev up; despite the high pitch, the engine would over-rev in inverted dives, sounding like a speed ignition engine with floating points. Although a wedge tank, point down, will run off during any normal rudder-only maneuver, abrupt pull-outs impose G-loads that compel a Walker pressure tank.

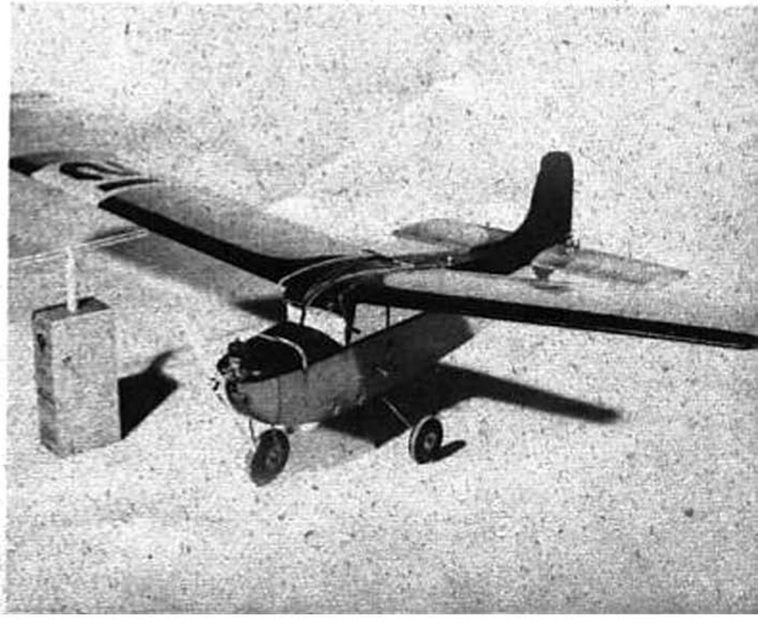
Flight characteristics, generally more like full scale than model, were different from any seen in 12 previous, more orthodox, layouts, so much so, in fact, that we misinterpreted hand glide symptoms and put the ship away for two months, thinking it a failure. (*Continued on page* 41)

PLANS FOR HIGH DIVER ON FOLLOWING TWO PAGES

Four intermediates fit snugly side by side, plug in for replacement. It is possible to fit all of the batteries here when smaller sizes used.



Compact lines distinguish the stunt airplane. Further development would lead toward cabin version of a U-control type stunt model. And why not?



High Diver

(Continued from page 23)

But a number of power tests finally were made, the first several of which, engine running rich, seemed even more distressing. But given enough power, the ship unexpectedly looked very good indeed.

The first hurdle in operating this kind of airplane is to forget pre-conceived notions about angular difference. The High Diver has 1/2° difference between wing and stabilizer incidence, and is longitudinally stable, whereas ordinary airfoil set-ups often exhibit a tendency to build up stalls with low angular differences. Increasing the angular difference with the 2412 decreased stability rapidly. This airfoil has a full scale type of stall: Slow the ship up enough and a panel will stall sharply, despite washout, and, as the wing tip falls, the plane goes into true spin rotation!

Therefore, (at this wingloading), the plane requires a fast, clean glide, and good flying speed at all times. DeBolt advised that his early symmetrical jobs would spin, defying recovery, even with elevator and rudder, when 3° decalage was reached, though a slight forward shift in CG had beneficial effects. Improperly thrown, or when out of trim, the test glide may actually fly over the top, nosing down in an arc, like a free flight job with too much angle in the stab. Nevertheless, this did not show up during 38 test flights, including plenty of tucked-under dives; recovery is sharp from any position. A minute increase in downthrust will cause a nose-down tendency after launching. The plane is sensitive to thrust adjustments.

Banked slightly, the ship will rock out, but overbank, and it will continue in the direction you left it until taken out with opposite rudder. When you get used to this characteristic, you can start a turn, release the button, and the plane will complete a 360 by itself. Coming back into the wind, it will not balloon, nosing up very slightly as ground speed falls off. But it keeps boring along. Despite the theory boys, the convex section appears to stall sooner than the flat bottomed jobs, but slight stalls to regain flying speed are common on low powered planes, big or little, and 3-3/4 lb. is a lot for a .15 when flying nose high. A .19, here, would pull the ship on through.

The 2412 airfoil will allow the plane to tuck under in a dive, and continue on past the point where the flat bottomed jobs straighten out into a high speed inverted dive. Narrow chord flippers, as on the Acrobat, permit vertical fast dives and continuous loops as long as the button is held, but there is no chance of forcing the ship around an outside corner. With fairly large flipper movement, the High Diver will tuck under, going vertical within 10 ft., beginning to go under at about 25-35 ft., and onto its back, but at a 45° angle to the ground. The nose may hunt up and down as real high speeds are attained, while the engine runs away. Increased elevator movement decreased this angle to the ground, made smooth the dive path, but did not quite attain to the horizontal inverted.

The difficulty with escapement elevators is the all-or-nothing position. Large area and elevation movement produce abrupt dives, etc., but make pull-outs so tight that loads result in a high speed stall, like a ukie with too small a stunt wing, and an oval loop results. The dive should be barely established, then the nose allowed to rise for the loop, being pulled over the top at last with up-elevator. Pretty flying would result with small movement, but violent stuff cannot be done. A trimmable tail, possibly with servos, would allow realization of both conditions.

Though possessed of a more or less normal glide, the High Diver is not a floater. It reaches out and covers a great deal of distance, which calls for special handling in hitting a spot. Unfortunately, any playing around with rudder for a tight turn setting up the approach expends altitude so that it is possible to end up short, despite the ground covering glide.

It is the freedom from ballooning that points up the specifications of a still more maneuverable airplane, one that might perform outside loops even with escapements. This trait allows a radical decrease in wing loading without ill effects. It has been established that low aspect ratios are feasible; certainly, 5 to 1 is satisfactory. As much as 2 in. of chord could be added to the present wing, with a corresponding increase in airfoil thickness, and lowering of the wing loading figure. A plugged .19 would provide the additional power to offset the drag increase; perhaps a lower pitch propeller would cut down on dive speeds, enabling the ship to tuck under quicker for the outside loop attempt, before G-loads can build up to squash the plane out the bottom of the loop.

Washout proves a handicap for inverted flight at slower speeds, coming off the top of an inside loop. Washout then is wash-in. With the tendency of this section to stall at low speeds, this wash-in causes a tip to stall and the plane to roll upright. Incidentally, full down was held after this occurred once, and the ship went on around, back to the inverted position, entered an inverted flat spin, recovered, then flew aimlessly about the field, going off occasionally on different headings. All this at low speed. The proper approach to fully stuntable RC machines is to avoid washout, instead using a wedge shaped spoiler at the center section along the leading edge. This causes the center to stall first, roughly the same as making the tips stall last, but the action is the same whether the plane is on its back or right side up. This idea has been used elsewhere.

The aerodynamic balance is necessary on the rudder when the old style Bonner compound is used; high speeds do not then push the rudder back to neutral, which takes a ship unexpectedly out of a spiral. A diamond shaped opening in the rudder yoke, where it rides on the escapement pin, is required to eliminate overtravel of the rudder on these escapements. This is desirable in high speed flight, because a rudder wobble from side to side when flippers are used throws the plane off its heading and slows it down. The faster the ship, the worse the consequences.

The High Diver will take any of the standard receivers on the market. We used Jack Port's 27.255 receiver for 38 flights, it, too, being under test for subsequent coverage. This receiver was hung by rubberbands attached to hooks on the corners of the chassis. Appropriate hooks can be attached inside the cabin. Some receivers can be mounted upon a block of foam rubber, held to a thin plywood slide by means of light rubberbands and hooks; the slide would go in vertically against the front cabin bulkhead. A bottom hatch is arranged just forward of the rear wheels: four intermediates fit snugly side by side, when a little wood is shaved away to provide a tight fit. Hooks and bands hold the hatch in place; make it tight so that centrifugal force won't eject the batteries out of the bottom. Two of these batteries are for heater, two for escapements. Two pencells are adequate, however, for radio, but don't cut down on escapement batteries unless flying one escapement only, in which case two pencells are enough.

This battery pack was wired to a plug and socket for quick replacement, the socket being in the botttom of the 1/16 ply floor. A K-45 67-1/2 volt B battery slides through the opening in bulkhead B-B, is packed in place. A slide receiver mount would retain the battery. A five-pin plug on the receiver cable will go into a socket placed well back on the ply floor, but from the top inside the cabin. A second 1/16 in. ply floor, matching the top view contour of the ship, extends from the firewall to bulkhead B-B, lending great strength to the nose. Note that, on the top view, various thicknesses of overlapping side sheeting may be seen forward of the wing. The mounts, forward bulkheads, and the sections of reinforcing sheeting are assembled after the one-eighth sides are in place, then the whole is sanded to the proper top view shape.

The torsion bar nose wheel gear is an English development that takes any abuse. The axle extends up from each side of the wheel, then reverses itself to cross the fuselage, finally doubling back for attachment to the ply floor. The portion that is parallel to the axle, where it passes through the wheel, is placed inside a wrapping of tin, the seam of which is soldered. However, the wire itself must be free to twist.

The lower, or rudder escapement, is a Bonner compound. Make sure you have the maximum travel possible; otherwise, sufficient rudder movement may not be possible later. The elevator escapement is a self-neutralizing type, operated by means of the extra control contacts of the compound. Ours was a new Macnabb Citizen-Ship. A torsion bar linkage was found necessary as a push-pull deal did not move the flippers well enough when the plane was in extreme attitudes. With the torsion bar, the rather large counterweight on the elevators was safely eliminated; moreover, necessary large movement could be had. Be sure to note the three-point wing rubber hold-down, for the front. A single dowel is not to be relied upon; it may even break up the structure when the ship is wrung out. Escapement rubbers are accessible through holes in the bottom of the fuselage: bend a wire fitting for handling rubber.

If you have had no elevator experience, fly the ship with rudder alone, using elevator only for positioning the ship prior to a special maneuver or to achieve maneuvers not possible with rudder. A trimmable tail would allow flying by elevator. END