

ROTARY-WING AIRCRAFT

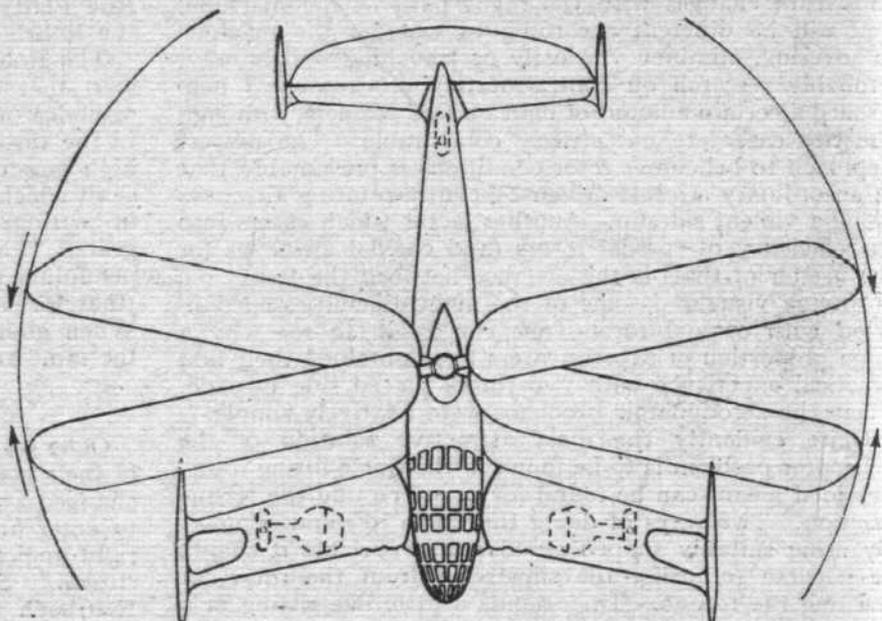
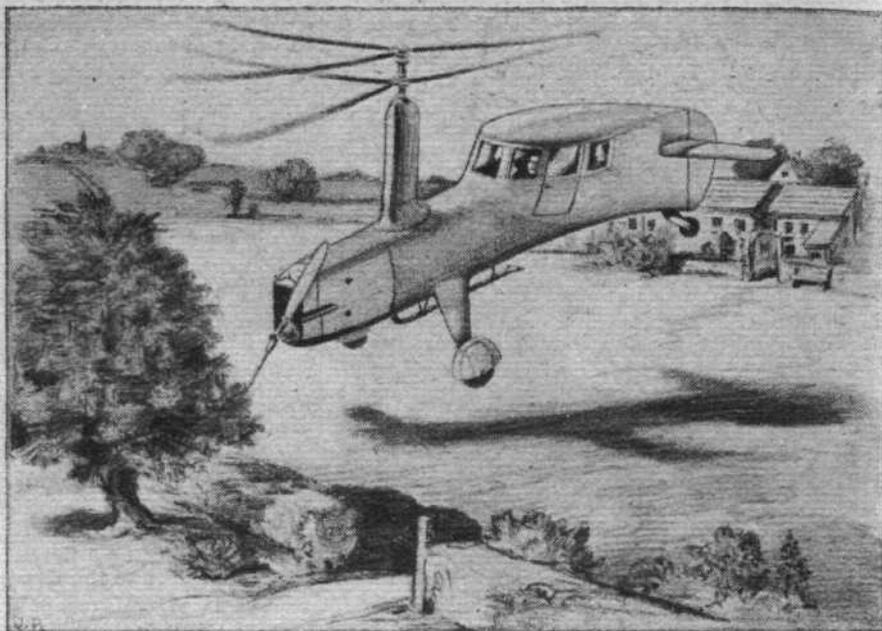
The wings of the Rohrbach helicopter projected 14ft. 6in. on each side of the fuselage. Maximum speed of the rotor was 420 r.p.m., which gave the blades a peripheral speed of about 170 m.p.h. At the top of the circle the blade speed was, of course, highest, since it had the aircraft speed added to its peripheral speed. The estimated top speed of the machine was about 120 m.p.h., so that at the top of the circle the blades were meeting the air at 290 m.p.h. or so. A freewheel was incorporated so that by setting the blade angles the pilot could ensure autorotation when the engine stopped. The machine was, so far as we know, never completed, possibly due to the fact that Rohrbach's concern had to go into liquidation.

A Single-rotor Type

At about the time Dr. Rohrbach was developing his paddle plane in Germany there came to England two young Austrians, Nagler and Hafner, with designs and plans for a helicopter. For a time they established themselves at Heston, and one of our pictures shows their machine. It was of the single-rotor type, and it will be seen that torque reaction was counteracted by two wing-like surfaces placed on edge. The engine was a small Salmson air-cooled, and was of inadequate power, but the design taught the two young inventors a great deal. Ultimately Nagler and Hafner parted company, each going his own way. Nagler produced another machine, called the helicogyro, which was a combination of helicopter and gyroplane in that it could be flown either with the rotor driven or windmilling. A pusher engine was installed, and the single rotor was of the two-bladed type. The tail surfaces were arranged to counteract the torque of the driven rotor.

Herr Hafner (who has since become naturalised) formed his own firm, the A.R.111 Construction Co., and shelved helicopter work in favour of the gyroplane referred to in the first article in this series (March 25th, 1943). He did not, however, abandon work on the helicopter type, and some years ago he showed *Flight* the drawings of a very neat single-rotor machine in which the torque was counteracted by shaping the fuselage something like a wing "on edge." War interrupted progress for a time, but it is to be hoped that work will be resumed. The design was certainly promising.

In France it was M. Louis Breguet who made the greatest progress. He had become convinced of the basic advantages of the helicopter, and although the machine shown in our photograph should be regarded as a "flying test bed" rather than as a serious aircraft, the mechanism of the rotor head, and the action of the rotor blades, provided



Two helicopter designs by Oskar von Asboth. The upper is a *Flight* artist's impression of an earlier type. The plan view shows the machine that was being designed shortly before the outbreak of war. In this the tractor airscrew had disappeared.

useful data for application later to a more practical machine.

The Breguet helicopter, it will be seen, belonged to the coaxial twin-rotor class. Torque reaction was, presumably, counteracted by aerodynamic tail surfaces (information is somewhat scarce on that point). The rotor blades were hinged by universal joints so that they were free to "flap" and also to vary their spacing in a horizontal plane. That the degree of freedom was excessive seems to be shown by the fact that on one occasion the pilot, while making a turn, throttled down too much, with the result that centrifugal force was insufficient to hold the



In its earlier stages the Sikorsky VS-300 had four rotors, a main lifting rotor and three control rotors. This was simplified later (as shown in the picture on the next page) into two, the main rotor and an airscrew at the stern for countering torque and for directional control.