As why flies the helicopter

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Abstract

In aircraft, especially in destroyers, the durable wings, which during the turns experience large loads. In helicopters the wings be absent, but the propeller blades, which ensure lift, it is in no way similar to the wings of aircraft. Moreover, these blades are so elastic that at rest they even sag under the dead weight. As such, it would seem, fragile wings, ensure the lift of such heavy helicopters.

Let us examine the situation, depicted in Fig. 1. To the axis on the threads are fastened two loads, which revolve around it some by angular velocity. Loads revolve not freely, but roll, relying on supports, as shown in figure.

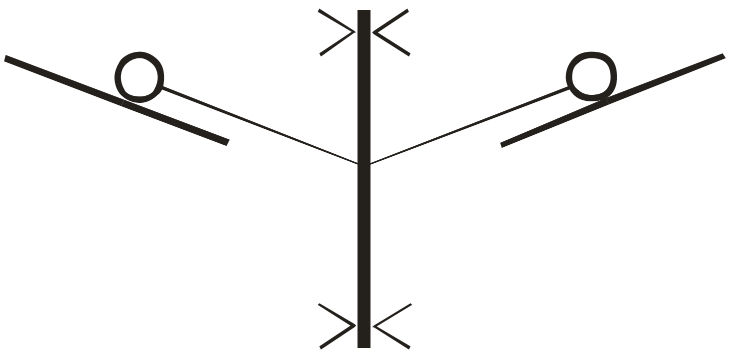

Fig. 1.

This situation is very close to that, which occurs for the screw of helicopter, if we count that the force, which acts from the side of supports to the loads, it is equal to the blade lift of screw.

On Fig. 2 is depicted the blade element dl, whose mass m.

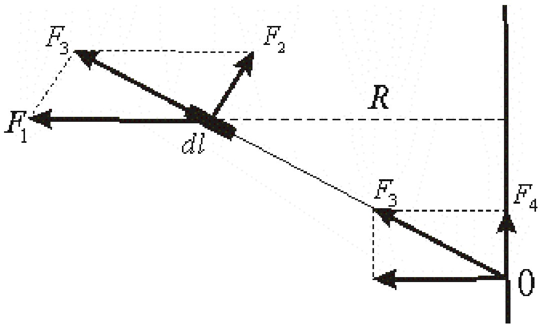

Fig. 2.

Blade is fastened to the propeller axis at point 0. Fastening is accomplished on the hinge in such a way that the propeller blade would have the capability to pivot in the plane of figure. During the flight the propeller blades are elevated upward to the specific angle between the line of the force of F_1 and the direction of blade. The centrifugal force, which acts on the blade element of $F_1 = m\omega^2 R$ depends on the mass of element. The lift of the blade element of $F_2 = K\omega R$ depends rel.un. of peripheral speed. This force depends also on the area of element and its angle of attack, these parameters enter into the coefficient of K. The vectorial addition of the forces of $F = \sqrt{F_1^2 + F_2^2}$ through the body of blade is applied to the propeller axis. This force, being decomposed, gives the lift of F_4, applied to the axis.

Expressions for the lift has the form of $F_4 = \frac{F_2}{F_1}\sqrt{F_1^2 - F_2^2} = \frac{KR}{m}\sqrt{m^2\omega^2 - K^2}$ in order to obtain total lift one should produce the integration lengthwise of blade and multiply by a quantity of blades.

Thus, the centrifugal force of F_1 together with the lift of F_2 forms the force of F_3, which extends propeller blade, giving to it hardness. Usually the angle of the slope of screw with respect to the screw axis is close to 90 degrees; therefore tensile force occurs considerably more than lift, that also gives blade high hardness. The tensile force of F_3, applied to the screw axis, forms the lift of F_4. Consequently, this force is the reaction product of the centrifugal force, applied to the blade elements of screw, and the lift, applied to the same elements.