BUILDING AND FLYING AN AEROPLANE. PART I. INSTRUCTION PAPER

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PART I

INSTRUCTION PAPER

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BUILDING AND FLYING AN AEROPLANE

PART I

One of the commonest phases of interest in aviation is the desire to build a flying machine. In fact, this is very frequently the first thing the experimenter undertakes after having gone into the theory of flight to some extent. Only too often, no effort whatever is made to get beyond theory and the machine is an experiment in every sense of the word. An experience of this nature is costly —far more so than is agreeable for the student, and is likely to result in disgusting him with aviation generally. There are hundreds of schemes and principles in the art that have been tried again and again with the same dismal failure in the end. Refer to the story of the Wright Brothers and note how many things they mention having tried and rejected as worse than useless. About once in so often someone "rediscovers" some of these things and, having no facilities for properly investigating what patent attorneys term the "prior art" (everything that has gone before, from the beginning of invention, or at least patented invention) becomes possessed of the idea that he has hit upon something entirely novel and wholly original. There is no desire in the present work to discourage the seeker after new principles—undoubtedly there are many yet to be discovered. The art of flight is in its infancy and there is still a great deal to be learned about it, but there is no more discouraged inventor than he who discovers a principle and, after having experimented with it at great expense, finds that it is only one of many things that numerous others have spent considerable money in proving fallacious, a great many years ago.

If it be your ambition to build a flying machine and you believe that you have discovered something new of value, it will be to your interest to retain a responsible patent attorney to advise you as to the prior art, before expending any money on its construction. You will find it very much more economical in the end. There are probably not more than half a dozen men alive in this country today who "know all the schemes that won't work." The average seeker after knowledge is assuredly not likely to be one of these few, so that until he knows he is working along new and untried lines that give promise of success, it will pay him to stick to those that have proved successful in actual practice. In other words, to confine his efforts in the building line to a machine that experience has demonstrated will fly if properly constructed and, what is of equal importance, skilfully handled. Build a machine, by all means, if you have the opportunity. It represents the best possible experience. But as is pointed out under the "Art of Flying," take a few lessons from some one who knows how to fly, before risking your neck in what is to you a totally untried element. Even properly designed and constructed machines are not always ready to fly. An aeroplane needs careful inspection of every part and adjustment before it is safe to take to the air in it, and to be of any value this looking-over must be carried out by an experienced eye.

BUILDING AEROPLANE MODELS

The student may enter upon the business of building to any extent that his inclination or his financial resources or his desire to experiment may lead him. The simplest stage, of course, is that of model building and there is a great deal to be learned from the construction and flying of experimental models. This has become quite a popular pastime in the public schools and some very creditable examples of work have been turned out. The apparent limitations of these rubber-band driven models need not discourage the student, as some of the school-boy builders have succeeded in constructing models capable of flying a quarter mile in still air and their action in the air is wonderfully like the full-sized machines.

Models with Rubber-Band Motor. The limitations of the available power at command must be borne in mind, as the rubber-band motor is at best but a poor power plant. It is accordingly not good practice to have the spread of the main planes exceed 24 inches, though larger successful models have been built. In attempting to reproduce any of the well-known models, difficulty is often experienced in accommodating the rubber-band motor to them, as even where the necessary space is available, its weight throws the balance out entirely, and the result is a model that will not fly. This has led to the production of many original creations, but these, while excellent flyers, would not serve as models for larger machines, as of necessity they have been designed around their power plants. The rubber bands for this purpose may be purchased of any aeronautic supply house. The most practical method of mounting the motor is to attach it to the rear end of the fuselage, usually a single stick, which is accordingly made extra long for that purpose. At the other end it is attached to a bent wire fastened to the propeller in order to revolve the latter. An easy way to wind up the motor is to employ an ordinary egg beater, modified as described below, or a hand

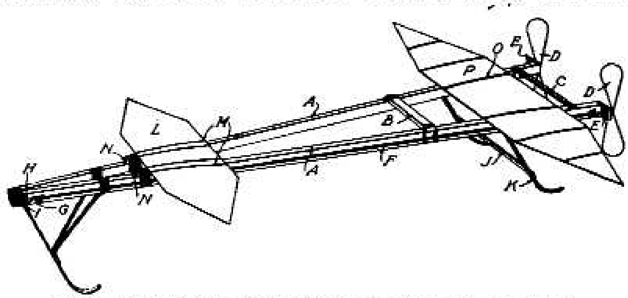

Fig. 1. Details of Main Frame of Rubber-Band Driven Aeroplane Model

drill, inserting a small wire yoke in the jaws in place of the usual drill, or bit. This yoke is placed so as to engage the propeller blades, and the latter is then turned in the opposite direction, storing energy in the rubber band by twisting its strands tightly.

For those students who do not care to undertake an original design at the outset, or who would prefer to have the experience gained by building from a plan that has already been tried, before attempting to originate, the following description of a successful model is given. This model can not only be made for less than the models sold at three to five dollars, but is a much more efficient flyer, having frequently flown 700 feet.

Main Frame. The main frame of the model monoplane consists of two strips A of spruce, each 28 inches long, and measuring in cross section $\frac{1}{4}$ by $\frac{3}{8}$ of an inch. As shown in Fig. 1, the two strips are tied together at the front with strong thread and are then glued, the glue being spread over and between the windings of the thread, Figs. 1 and 2. The rear ends of these strips are spread apart $4\frac{1}{4}$ inches to form a stout triangular frame, and are tied together by cross bars of bamboo *B* and *C* which are secured to the main strips *A* by strong thread and glue.

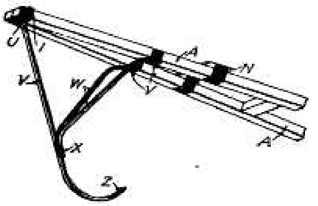

Fig. 2. Details of Forward Skids of Aeroplane Model

Propellers. The propellers *D* are two in number and are carried by the two long strips *A*. Each propeller is 5 inches in diameter, and is whittled out of a single block of white pine. The propellers have a pitch of about 10 inches. After the whittling is done they are sandpapered and coated with varnish. The thickness of the wood at the hub E_2, Fig. 3, of the propeller should be about $\frac{3}{8}$ inch. At the rear ends of the strips *A*, bearing blocks E_1 are secured. These bearing blocks are simply small pieces of wood projecting about $\frac{3}{8}$ inch laterally from the strips *A*. They are drilled to receive a small metal tube T_2 (steel, brass, or copper), through which tube the propeller shaft T_1 passes.

The propeller shaft itself consists of a piece of steel wire passing through the propeller hub and bent over the wood, so that it can not turn independently of the propeller. Any other expedient for causing the propeller to turn with the shaft may obviously be employed. Small metal washers T_3, at least three in number, are slipped over the propeller shaft so as to lie between the propeller and the bearing block.

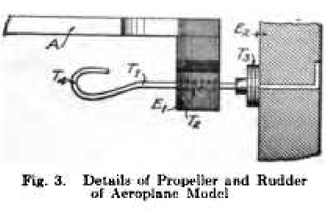

Fig. 3. Details of Propeller and Rudder of Aeroplane Model

That portion of the propeller shaft which projects forwardly through the bearing block E_1 is bent to form a hook T_4. To the hook T_1 rubber strips *T*, by which the propellers are driven, are secured. The rubber strips are nearly as long as the main strips *A*. At their forward ends they are secured to a fastening consisting of a double hook *G H*, the hook *G* lying in a horizontal plane, the hook *H* in a vertical plane. The hook *G* holds the rubber strips, as shown in Figs. 1 and 4, while the hook *H* engages a hook *T*. This hook is easily made by passing a strip of steel wire through the meeting ends of the main strips *A*, the portions projecting from each side of the strips being bent into the hooks *I*.

Skids. Three skids are provided, on which the model slides, one at the forward end, and two near the rear end. All are made of bamboo. As shown in Fig. 2 the front skid may be of any length that seems desirable. A 6-inch piece of bamboo will probably answer most requirements. This piece *N* is bent in opposite directions at the ends to form arms *Z* and *U*. The arm *Z* is secured to the forward ends of the two strips *A*, constituting the main frame, by means of thread and glue. The strips and skid are not held together by the same thread, but the skid is attached to the two strips after they have

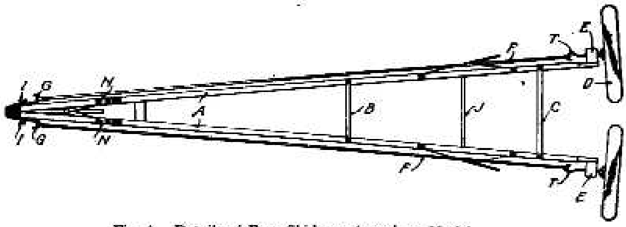

Fig. 4. Details of Rear Skids on Aeroplane Model

been wound. Hence, there are two sets of windings of thread, one for the two strips *A* themselves, and another for the skid and the strips. Strong thread and glue should be used, as before. In order to stiffen the skid, two bamboo struts *W* will be found necessary. These are bent over at the ends to form arms V_1, Fig. 2. Each of the arms is secured to the under side of a strip *A* by strong thread and glue. The arms *X* are superimposed and tied to the bamboo skid *V* with strong thread and glue.

The two rear skids, of which one is shown in Fig. 5, consist each of two 5-inch strips of bamboo *S*, likewise bent at either end in opposite directions to form arms S_2 and S_3. The arms S_2 are fastened to the strips *A* by strong thread and glue. To stiffen the skids a strut C_1 is provided for each skid. Each strut consists of a 3-inch strip of bamboo bent over so as to form arms C_2. Strong thread and glue are employed to fasten each strut in position on the strip and