THE FIRST AEROPLANE FLIGHTS OF THE BOY AVIATOR

Plans for making rubber band aeroplanes appeared in the Junior Call some time ago, but some of the readers of the page have found the plans too difficult, and therefore we are publishing today a set of simpler plans which boys and girls who have not been accustomed to making articles from plans may be able to follow successfully. The article first tells how to make a glider, which is an airship without power. After that the article explains how rubber bands and a propeller may be added to the glider so that it will have motive power. Read carefully all of the advice given in this article and you will be able to make a successful start in aviation, even if you have never studied the topic before.

THE simplest form of any flying apparatus is one that advances through the air after having motion imparted to it by the propelling energy of the hand. With no source of power carried in the air, as is the case in machines operated, for instance, by twisted rubber, the duration of flight is, naturally, more or less brief.

These "gliders," as they are called, however, are valuable in teaching the proper balance of models, because surfaces that glide well without power will fly well when a propeller is added.

Probably the easiest made but most successful small glider ever devised is that which consists of a single middle stick across which at each end is fastened a thin strip of wood or pasteboard, a small vertical rudder being attached to the stick either under or at the rear of the larger of the two cross surfaces.

It has been found that with this type of glider—i. e., when no motive power is used, the best results are obtained with the small plane in front. When a propeller is used it is placed in front of the large surface, which then becomes the leading plane, and the vertical rudder is placed under the small plane in the rear.

The proper material of which to make the surface in order to obtain the longest flight is straight grained spruce about one-sixteenth inch thick, the edges being beveled until almost sharp, an effect that can not well be obtained with cardboard, especially if it is heavy. One boy, not to be deterred by lack of material, said he intended to try a strip from a beach basket. The stick that supports the planes should be straight grained spruce (or ash), one-quarter by three-sixteenths of an inch in diameter. A small wire may be twisted around the stick in front of the small plane and turned back, to act as a shock absorber and protect the leading plane. (See E. Fig. 3.)

Material and parts for models of all kinds are now sold by a number of dealers, but this article is written in an endeavor to help those who are not yet in touch with such sources of supply.

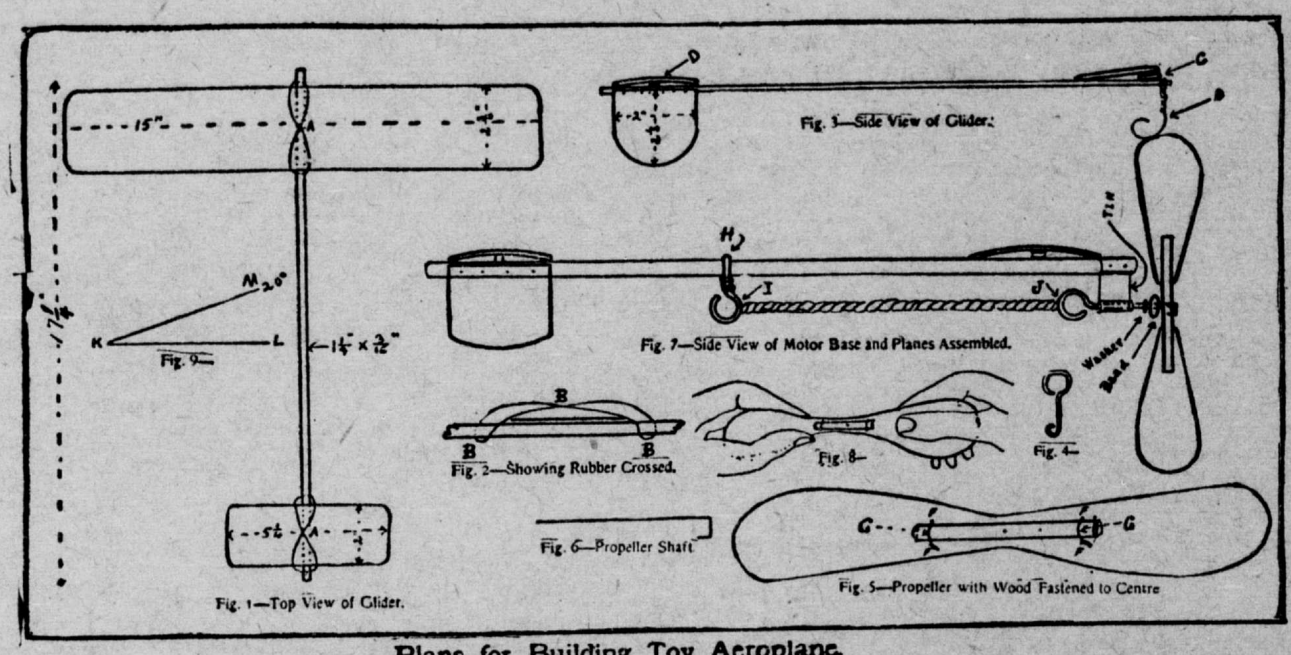
As every boy can certainly get a pasteboard box, a piece of string, a stick about 17 inches long and one-quarter inch in diameter, four ordinary pins and have at least temporary use of a knife or pair of scissors, if he will add a stock of patience and perseverance he can have a glider if he desires. By adding a little more work and an outlay of 10 cents for a pair of pliers and some rubber bands, and perhaps 1 cent for a stick, he may have a power driven flying model.

If a square stick is not available buy a dowel, which is a round stick sometimes used by carpenters and upholsterers instead of a nail. They are made of spruce, about 36 inches long, and from three-sixteenths of an inch to three-quarters of an inch in diameter. These sticks **may be obtained** from hardware stores, door and window molding dealers, and carpenters, at a cost of 1 cent each for the smaller sizes. While we do not pretend that a round stick will be as satisfactory as a square one, it will be better than no stick, especially if it is flattened with a knife where the edges of the planes rest, as this will enable them to remain in place better than on the rounded surface.

It must be borne in mind, however, that all models, no matter what make, must be "trued up" after each flight.

Having procured, say, a dowel (or its substitute) one-quarter inch in diameter, cut off a length of one and one-half inches from the most perfect end, lay carefully aside, and cut in half the remaining piece of dowel and use one half of it for glider, the other half for power machine.

Cut from very stiff cardboard or a pasteboard box (if thin wood can not be had) one piece 15 inches long and 2¾ wide, for rear supporting plane; one piece 2½ inches long by 2 inches wide, for vertical rudder, and one piece 5¼ inches long and 2 inches wide, for front elevating plane.



Plans for Building Toy Aeroplane.

Round the corners as shown in Fig. 1 and attach to stick by crossing and wrapping string over the surfaces and around the stick, as shown at A, A, Fig. 1. Use the pins to attach the vertical rudder by driving them through the pasteboard and stick and pounding them flat on the rear side.

Rubber bands are excellent for holding the surfaces in place instead of string, as their elasticity permits the planes to spring when striking the ground after flight, thus preventing the injury that naturally occurs to a rigid structure. They also are convenient when packing or carrying the glider, as the parts are easily separated and assembled. They are slipped over the surfaces and stick, as shown at B, B, B, Fig. 2.

Under the front surface, between it and the stick, insert a small wedge (about two or three thicknesses of the cardboard) endwise, at front edge (see C, Fig. 3). This will give stability, but shorter flight than if the wedge is put crosswise. Under the rear surface, about one-half or one-third the distance from its front edge, insert a similar wedge crosswise (see D, Fig 3). This is to give the requisite curvature to the surface.

Be sure to glance across the planes after each flight to see that the planes **are exactly** horizontal to each other, and the vertical rudder directly at right angles to the plane above it. Also, especially if the planes are to be permanently fastened to the stick, balance the model on the finger or across a stick, to see whether they balance evenly along their length and do not slip to right or left.

Launch by inclining upward and throwing forward, preferably facing a light wind. When released from a height of, say, 12 or 15 feet (a second story window or balcony, for instance) these models have been known to glide nearly 200 feet; they frequently glide in a circular path with an undulating motion, when well balanced, and then either regain their original direction or return almost to starting point.

How to Convert a Glider Into a Power Driven Machine—Cost 10 Cents.

Material and tools required:

Piece of tin 6 inches by 1¼ (tin can will do).

Piece of tin 2 inches by 1½ inches.

Piece of wire about 6 inches by 1-32 of an inch diameter (heavy wire hairpin will do).

One bead and washer, or two beads, or two washers.

The surface and stick of glider already made.

One pair pliers (from 5 and 10 cent store), 5 cents.

Rubber band, or bands, 5 cents; total 10 cents.

Remove the planes from the stick and flatten one end at the top and sides for a distance of about three-quarters of an inch. Bend the two inch piece of tin lengthwise and with the pliers form it over the squared end of stick until it is a close fit. Form the other end into a small tube by bending over a small wire nail that is but a trifle larger than the wire that is to be used as a propeller shaft. Slip the tin end thus formed on the end of the stick prepared for it, and if possible drive two small brads through, to keep the tin rigidly in place.

Propeller—Cut a piece of tin of the shape indicated at Fig. 5, six inches long and one inch wide. Carefully split a one and one-half inch length of stick one-quarter inch thick in two parts lengthwise, first making a hole (with a small brad) exactly in the center. Make a hole in the center of the tin blade and pass a wire or very small nail through the stick with the tin between the two halves. Drive holes (FF) through the tin and wire through them and around the sticks, as shown at GG, Fig. 5. This will give a firm hub in which to hold the propeller shaft. The ends of the sticks may be beveled or tapered down to improve the appearance of the work and lessen the resistance to the air, as well as for lightness.

Hold propeller as shown in Fig. 8 and twist the top of right hand blade toward you, left hand from you, until you have a pitch of about 20 degrees, as shown in Fig. 9, in which KL represents a flat surface and KM the blade if the propeller were held with the shaft in a vertical position. When holding the propeller as shown, with the pitch given, the side then toward you is the side to put next the front plane. (Wind from you.)

Cut a piece of wire about two inches long and bend the end as shown in Fig. 6. Slip the straight end through the hole in the propeller hub on the side opposite that which is to be next the front plane and drive the bent end into the wood. This will keep the wire which is to serve as the propeller shaft rigid with the propeller.

Long and narrow propellers (called "high pitch") revolve at high speed; short, broad ones (called "low pitch") revolve with less speed but greater force, and require more power to drive. Remember that in model work a propeller is larger in proportion to the size of the apparatus than it is on a full sized machine.

All propeller blades should truly balance when suspended on a wire run through the hole in the center of the hub and revolved when the wire is held in a horizontal position. When the propeller stops it should lie horizontal and not stand vertical or at an angle. Trim the edges of the blades until this effect is attained.

Over the wire propeller shaft slip two beads, or small washers made of tin will answer, if they are filed or ground on a stone perfectly flat after a hole is driven in the center with a nail. Then pass the end of the wire through the small tube formed in the tin on the end of the middle stick of the machine and form a hook to hold one end of the rubber bands. See Fig. 7, in which a space has been left between propeller and bead and washer to show their position. The rubber bands in tension will draw these close together.

About half way down the stick twist a piece of stout wire firmly around the stick and form another hook. See H, Fig. 7. It is most important that these two hooks should correspond in depth and center of curvature, as shown at I, J, Fig. 7, because if they do not the propeller shaft will be drawn out of line and will bind on its holder, and by causing friction and resistance to the revolution of the propeller materially shorten length of flight.

Extend rubber bands between the hooks and replace the surfaces used on the glider, or, preferably, make new ones covered with fabric, which will be lighter and compensate for the extra weight of the motive power carried. Prepare the machine for flight by turning the propeller from you with the forefinger of the right hand, the machine being held by the middle stick in left hand, until the bands are twisted 40 or 50 (sometimes more) times, i. e., until the bands have been twisted twice throughout their length. The bands should be under almost no tension until the winding is begun. If short bands are used tie them together at their ends with a string; do not loop them together, as they unwind often with a jerky motion.

On a rubber band motor it makes no difference whether the propellers are right or left handed except that care must be exercised to wind in the reverse direction to that in which the propeller is to revolve when released.

The motor base here described, with the propeller, may be used on fabric covered models of any design where larger surfaces are used, in which case, however, the rubber bands are usually carried on top of the planes, the planes then being placed between (or even under) the stick and rubber.

Do not attempt to fly models in a high wind, and remember that in any event it will take a little practice to learn to fly them at all, and that even then they may sometimes be erratic and work well at one time and fail the next. In that case examine carefully for balance of all parts.

Permit the propeller to make a few revolutions before letting the model leave the hand. If the machine flies in a circle or unevenly it is because the forward edge of one or the other plane is too low.

If the machine dives forward, lower the front edge and raise the rear edge of rear plane.

If the plane falls back, raise the front edge and lower the rear edge of rear plane.

If it turns over, one plane or the other is not absolutely straight from tip to tip, or they are not on a line with each other, or the pitch of the propeller may be too great, the propeller may be too large, or the rubber bands wound too tight.