GENE WALLOCK - TWIN PUSHER BUILDING AND FLYING TIPS

Model Selection

The success of a particular Twin Pusher (TP) is strongly influenced by the design simplicity itself. The SAM Approved Rubber and Glider Manual list 90 different designs that are approved for OT Competition. Light motors and construction are the main considerations. I've built the Simmers, Schmaedig and 4 Burnhams. I've found the Burnham to be a very simple to build competitive design and selected it as the example for this article (**Figure 1, and 2**).

Figure 1

Figure 2

General Construction Improvements

The 2 main rails of the basic A-Frame are the key to the strength integrity of the model. To maintain minimum weight I laminate the rails from medium-light balsa with a Carbon Fiber center. The main load on the rails occurs when both motors are fully wound. The worst load occurs when only one motor is attached. The A-Frame tries to act like a Divining Rod so strength in bending is a serious issue. I lost a Schmedig frame on a spin-in and the fully wound motors absolutely destroyed the structure. **Figure 3,** below, shows the top view of the rail laminate. Regular CA works fine for a bonding agent. Build a simple straight edge that will hold the rail during the lamination. After the CA sets, I turn the rail over and re-glue the opposite edge. Finish the frame per print. The bamboo X - Pieces are shaped from skewers available at you local market. A good razor plane is the easiest way to shape the bamboo cross-section into an oval. Be sure to run the bamboo X-Frame pieces through the rails and then CA them in place (**Figure 4,** below). Tie the bamboo cross-over joint with thread. The Simmers has balsa spacers in addition to bamboo diagonals. I used a short 1/16 dowel through the rail, into the balsa spacer, to maintain joint rigidity. Be sure to to run the bamboo X-Frame pieces through the rails and then CA them in place (**Figure 4**). Tie the bamboo cross-over joint with thread. The Simmers has balsa spacers in addition to bamboo diagonals. I used a short 1/16 dowel through the rail, into the balsa spacer, to maintain joint rigidity .

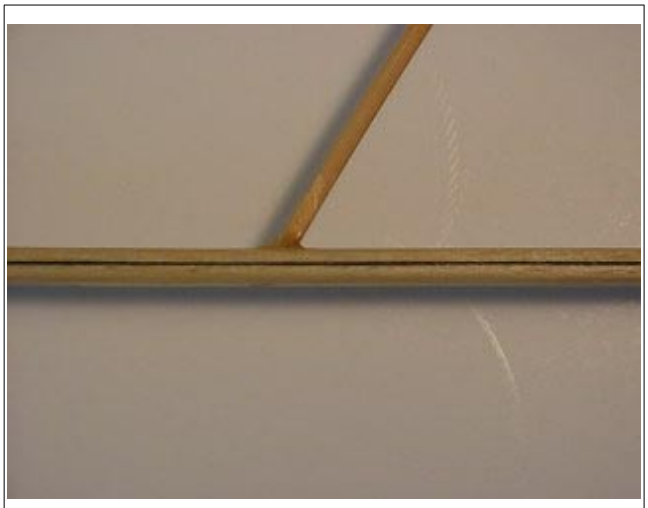

Figure 3

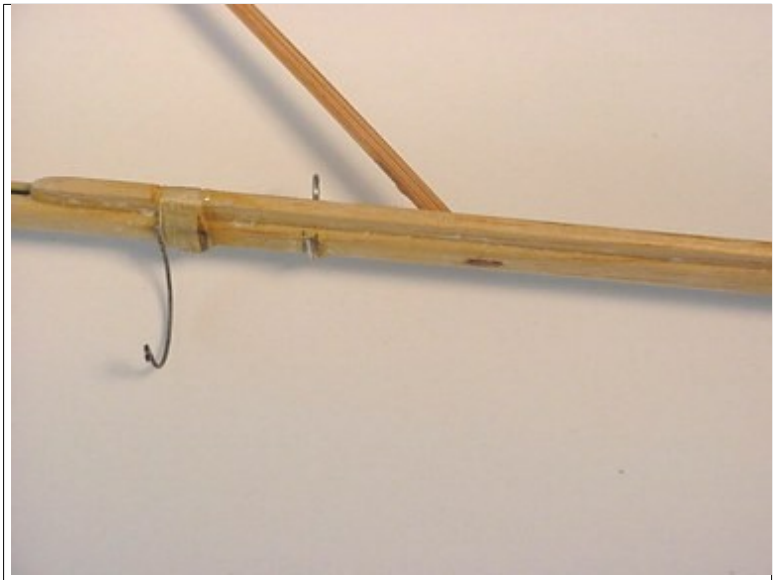

Figure 4

The prop hanger is the next area to spend some time on. I prefer a solid hanger instead of a bent up piece of aluminum. **Figure 5**, below, illustrates the one I used. I made up a ¼ O.D., 1 inch long aluminum tube and fitted an old wooden thrust button to one end. I backed it up with a short piece of ¼ dowel. CA the wooden parts. I drilled a 1/16 hole on center with a small lathe. I pushed in a 1/16 O.D. brass tube and glued it in with CA. I then drilled out the brass tube with a 3/64 (.048) dia. drill using the lathe. I used .045 wire for the prop shaft. I made a 3/8 thick pillow block for the prop shaft tube to sit in. I glued in the prop shaft tube to the balsa pillow block with CA. I glued the block to the frame rail with 1 degrees of downthrust built in (the aft end of the prop shaft tube is lower than the forward end). I do this to minimize stalling under power. I put in a light balsa fillet to reduce the stress concentration at the end of the prop mount. I use a free-wheeling drive that's made from .010 brass. A light spring and .045 I.D. Thrust Bearing finish the prop drive assy. I balance the props using sheet lead that's been hammered thin and flat. This is a lot lighter than continual doping and sanding. A few grams on the inside tip of the blade usually do the trick. -I CA a 1/8 wide strip of .007 CF across both sides of the prop center to prevent breakage. See **Figure 6**, below. Be sure to wrap the shaft mount and motor cans with thread.

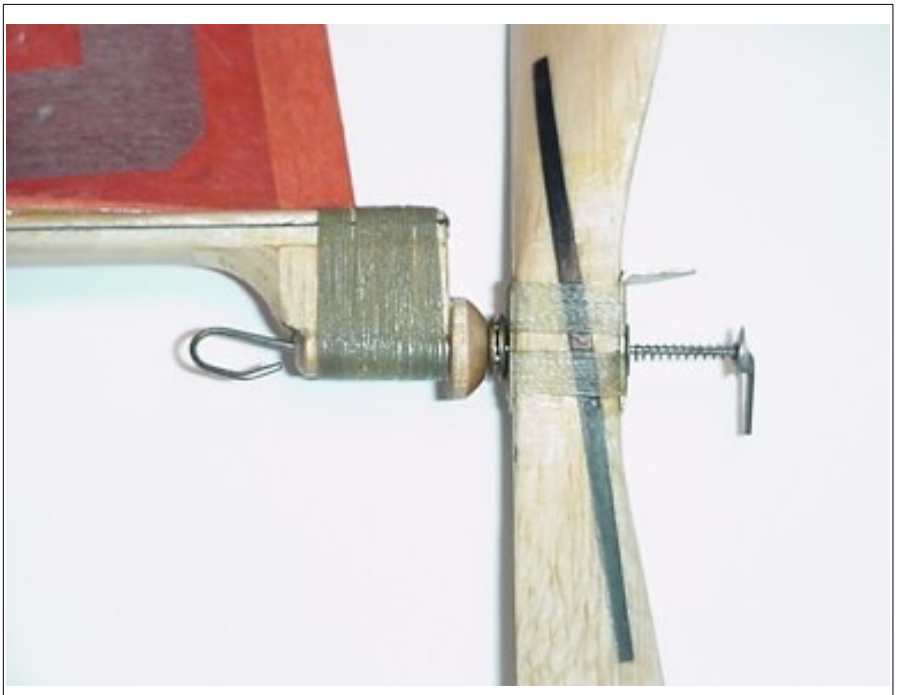

Figure 5

Figure 6

Model Assembly

Page 20 of Zaic's 1935-36 Year book has a simple way of locating the main wing position. If the plan you are using doesn't show the main wing location, use Frank's method. The wing T.E. on my Burnham #3 is 1 3/4inches ahead of the rear plane L.E. the group shot

(Figure 2) shows the variance in main wing position for optimum climb and glide. I make final adjustments gliding the model over tall grass and then low power flights. I correct stalling or diving with minimal front elevator incidence. You have to maintain a positive longitudinal decalage between the front wing and the main wing. If the model is not climbing increase the front wing incidence. You may have to move the main wing back slightly to get a smooth glide. It's not the end of the world if you have to add nose weight as a last resort.

Keying

It's mandatory to key the main wing and front wing positions for repeatability (**Figure 7**, below)) and to put positioning blocks on the rails to prevent cocking the surfaces (**Figure 8,** below). Key the main wing and install position blocks **after** you've established the optimum position. Where possible, I use aluminum wire for wing and stab hold down hooks and 1/32 Piano Wire for any other hooks. I use 1/32 round bamboo TE stiffeners on the rear top of the TE's to prevent deformation.

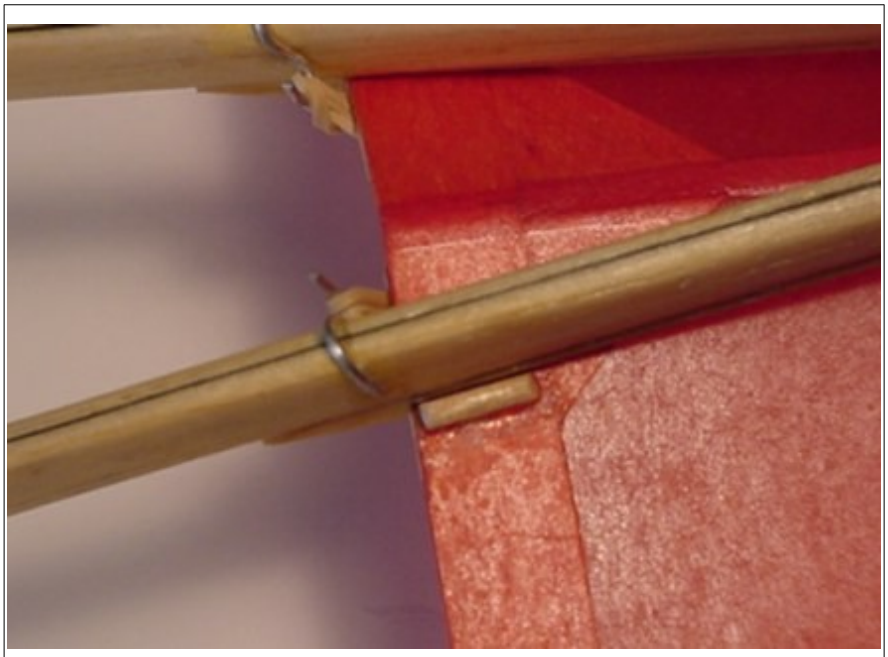

Figure 7

Dethermalizer

TP's fly very well and will thermal quite easily. It's simple to pop the front wing up at 45 degrees to bring them down. **Figure 9 & 10** show the top and bottom of the DT Snuffer tube arrangement. **Figure 11** shows a fuse installed. The fuse is mounted from the bottom and sits between the motors. I CA on .002 aluminum sheet protectors to prevent fires (.002 Aluminum is available from .062 Aluminum peel shim stock. Just throw a 1 inch square in Acetone overnight and you'll have 32 pieces). I've used the Burnham in a regular OT Rubber contest and put in 3 five minute max's in Small Stick.

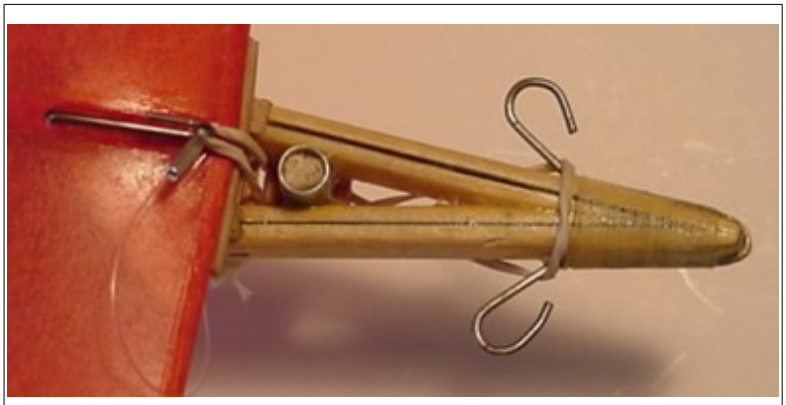

Figure 9

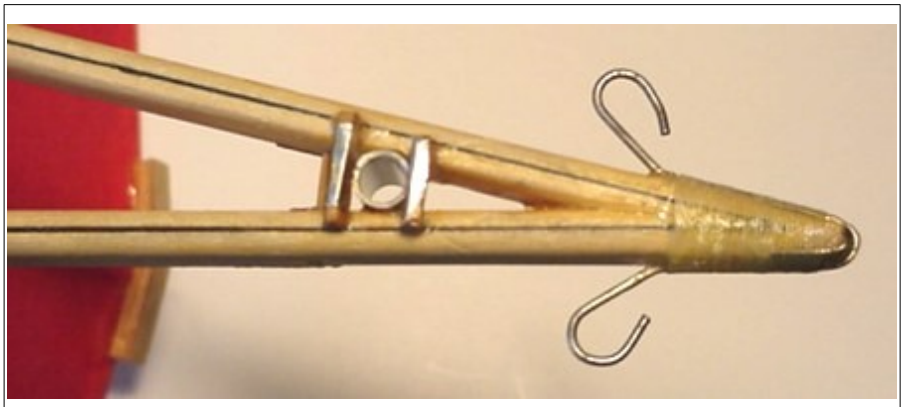

Figure 10

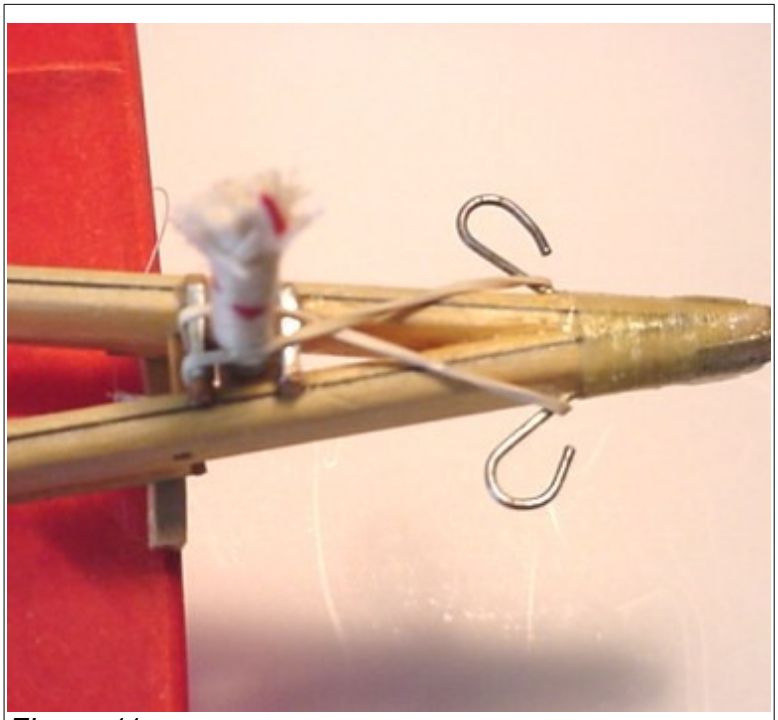

Figure 11

Power

I power the Burnham with 6 strands of 1/8 Super Sport, 37 inches long. I use medium Crocket Hooks (available from FAI Model Supply) to terminate the motor ends. These save a lot of Monkey Motion when winding the motors. They also provide a secure attachment to your TP Stooge during the winding. You normally don't braid TP motors. Make them from adjacent strands of rubber to maintain torque balance. When the motors are first made up, they should be almost taut between the hooks. The motors will stretch 15% after the first full wind and provide plenty of slack.

Twin Pusher Stooge

Most rubber flyers have a favorite stooge that's really not suited to TP winding. Instead of re-inventing the wheel, I made a simple adapter that mounts on the regular stooge and provides a secure and protective holder for your TP. The adapter (**Figure 12**) is a T-base with 1/16 dia. Wire pins to slip the Crocket Hooks over during winding and an elevated pad to hold the model nose high during winding in case a motor breaks. Eye bolts on the bottom (**Figure 13**) provide a positive hold down with a 1/8 dia stooge pin. Rubber bands hold the motor hooks down until you're ready to remove model for launch. The plug-in ramp holds the model away from the motors during winding to minimize any damage if a motor breaks. The TP Stooge may be adapted to a variety of similar layout. The Burnham and Schmaedig have non-staggered props and a simple slide mounted pin will accommodate the various widths. The Simmers has overlapping props and requires a staggered pin hold-down arrangement.

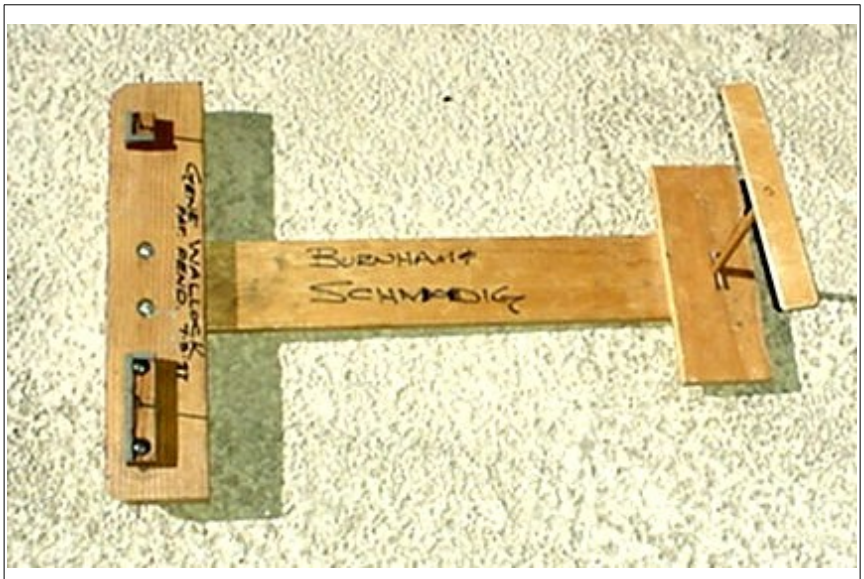

Figure 12

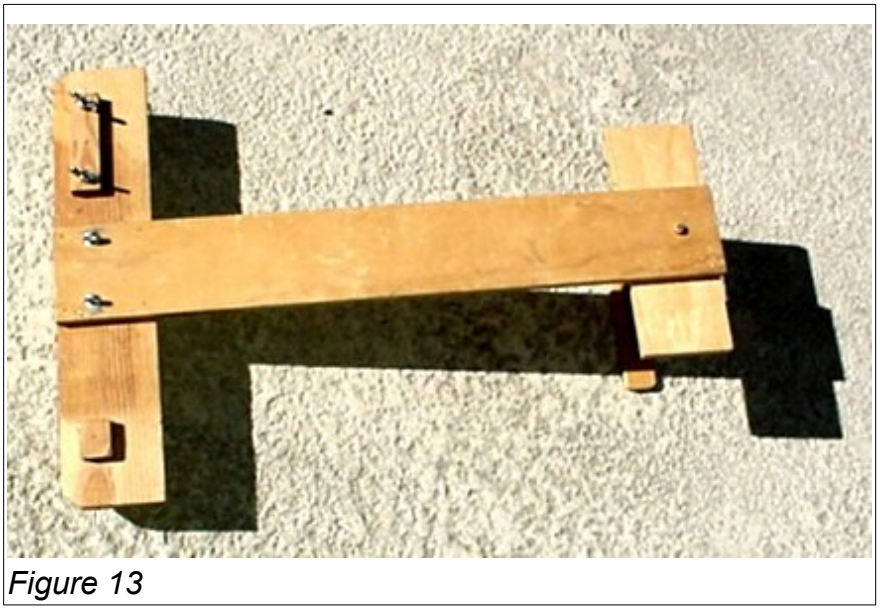

Figure 13

Twin Pusher Winder

If you don't have a winder that winds both motors in opposite directions, at the same time, you have a disadvantage in that you'll take twice as long to wind one at a tine and the first wound motor is losing power while you wind the second. **Figure 13** illustrates my winder , which is a modified Morrill Sidewinder. A 1:1 gear ratio is used to mesh the two output shafts. The counter gives me an idea of where I am turn wise. Before I had a dual output winder, I used to wind one at a time. I had to be sure to back wind the correct motor and start on the same one to make sure I had the weaker motor the same from flight to flight. A slightly banked launch was required to compensate for the inbalance.

My Winder

Winding The Model

Figure 14 shows the model mounted in the stooge, ready to wind. **Figure 15** shows the motor hooks banded down and the props in a clear position. Some plans show the rotation direction of the props. I've found that I'm quite comfortable winding in the same direction as a tractor model (bottom of the wind coming towards me and the top going away from me) so mount your props accordingly.

Figure 14

Figure 15

How Many Turns ?

There are a lot of charts that claim to show how many turns a motor will take. I prefer an empirical solution. Make up a motor from a given batch of rubber, pre-stretch it and wind it until it breaks. Make 4 more motors from the same batch. This is where light and small Twin pushers have an advantage. I usually put 1800 turns in my Burnham, but have wound to 2100 with a backup set of motors at the ready.

Launching The Model

After the model is wound, double check that the free-wheeling drives are engaged. Light the fuse or have your timer ready to do it just before you launch. Remove the bands holding the props down, grasp the props, double check the free-wheelers are engaged and lift the model off the Crocket Hook pins. At this point your model is ready for flight. Always launch at a 45 degree angle as straight as possible.

Putting Turn Into The Glide

A TP normally has a turn under power due to subtle warps and misalignment. When it finishes the power run, the flight turn direction is dependent on the same variables, except the props are free-wheeling. I use front wing tilt to turn the model in the glide; just like a tractor model. A 1/64 tilt will work wonders. The main thing to remember is the model will

tell you which way it wants to turn. There is no advantage of a left turn over a right turn. The side profile and end views of a Twin Pusher are very small and they can disappear from sight very quickly so adjust for turn as soon as possible.

Spare Motors

The worst thing that can happen is to be almost wound and see a broken strand or have one motor break. You don't have time to re-tie the strand and you don't want to replace one motor; Remember the torque imbalance. I have a spare motor board that holds a set of pre-wound motors (**Figure 16**). About 25 minutes until launch, I wind a set of motors and stow then on this board. Identify forward so you don't put them on backwards. If something happens to the set I'm winding on the model, I take off the model motors and replace them with the pre-wound ones. I've lost some torque from sitting, but at least I can fly. Your first thought when taking the motors off the model is to downwind them. You don't have time. Carefully remove them and put them in a plastic bag. Sort it out later.

Figure 16

I hope this has been some help and feel free to ask any questions.

I want to thank Mik Mikkleson for his patience in helping me when I first started flying Twin Pushers. He's a good teacher and a great competitor. Grant Carson has "Beat Mik" on his TP. This is a great compliment. It's always a better view if you're the lead dog.

Competition

And this is how it is supposed to look. Part of the Twin Pusher Mass Launch at the 2006 Muncie Champs.

Twin Pusher Mass Launch at the 2006 Muncie Champs.

And this is how it was, way back in the annals of model airplane flight development. The boy on the left is Carl Goldberg. Do you know the others? Please let us know if you do. This picture is part of the Comet Model Company archive, Nancy Kapitanoff; http://www.cometmodelnews.com/Home.html

Thermals

Gene Wallock