Retracting Gear Crusader Stunter

Ladies! Received a box of candy AND a bouquet from your spouse lately . . . no? If he is a serious control line stunt flyer who dreams of a retracting-gear entry, maybe you'd better read about this winner that, for once, doesn't look like a Nobler!

BY HAROLD L. PRICE

Designer HLP (above) with retracting landing-gear Crusader at last Westchester, N. Y., Flying Fair. Hez a postal clerk, served in Army as Comptroller's statistical illustrator.

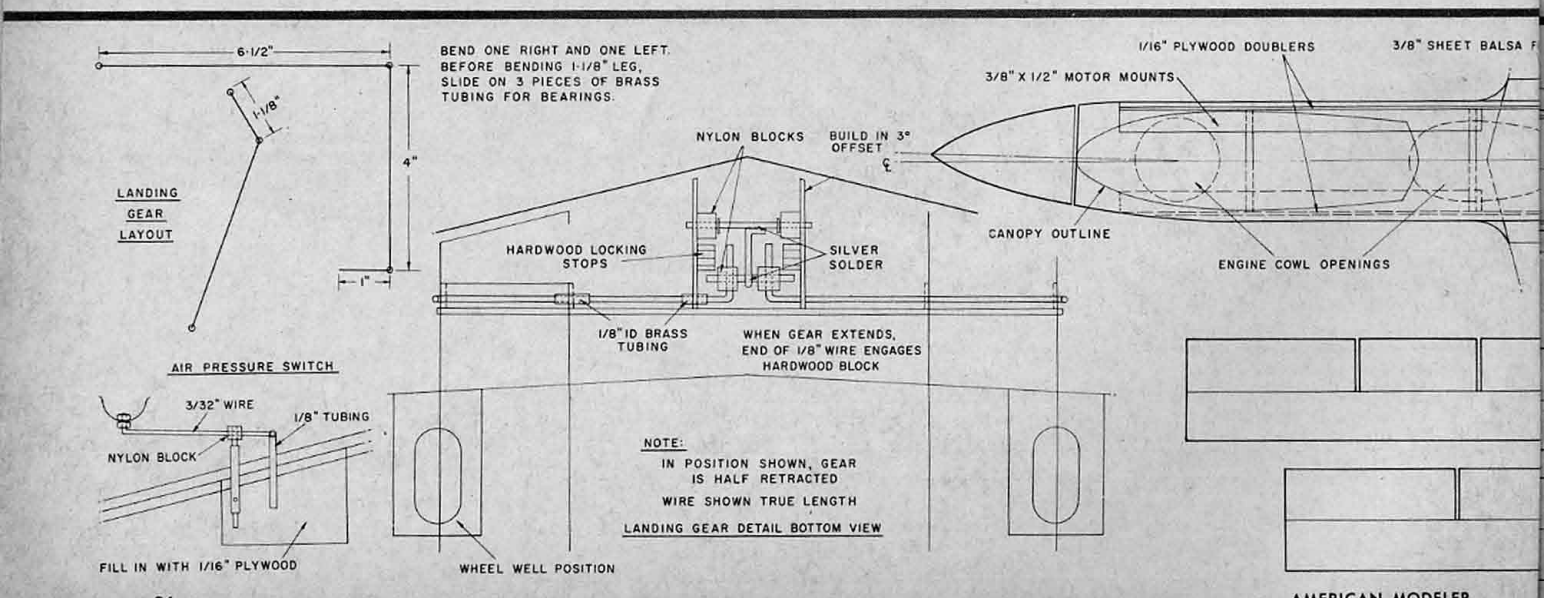
Your stunt model rolls along the blacktop runway, its tail lifts off, then the plane slowly climbs to level flight. That is the way it has been for as long as I have flown. But now the story is changed! No longer are those two-level laps something for the spectator to ignore. When your Crusader takes off everyone watches those initial level laps to see the retracting gear operate.

Our Crusader was developed as a semi-scale stunt with wing and stabilizer design based on my Valkyrie series. The jet fighter profile was added to provide the fuselage space needed for the retracting gear mechanism. Since most of the design refinement came during the time I was flying my Valkyrie, what you see here is the correlation of the three years development in both models.

With his Nobler at the 1951 Plymouth meet George Aldrich made a profound impression on stunt model design. Until then it was considered hard for a Ukie weighing 48 ounces to fly—let alone do a winning stunt pattern! George's contribution to stunt design is evident in 98% of today's competition models. To the untutored observer, all appear to be Noblers!

For the past twelve years, little consideration went to much but conventional tapered wing, with its fifteen to twenty percent maximum thickness at thirty percent chord. These offer great performance, so why change? However, no matter how you slice it, the wings all look exactly the same. With this in mind I began looking for a new concept in wing profile.

Recently many interesting ideas have been advanced by radio control builders concerning the characteristics necessary for a wing when flying at slow speeds. Actually, all of these problems can be related to control line stunt. What both groups are looking for is a wing which has good wind penetration, plus excellent lat-



eral stability which will give a plane good turning ability. I don't mean to say that this wing will solve all these problems, but it does go a step in the right direction. The liberal sweep back in the leading edge guarantees good wind penetration and low wing tip area improves lateral stability. A 22% airfoil along with a well rounded leading edge makes this a wing which has excellent low speed turning ability without sacrificing smoothness.

My first attempt at building the wing was incorporated in Valkyrie I. The wing area of over 600 square inches put it in the big stunt class. With a sporty yellow finish this model weighed in at 47 ounces. First flights showed its many good qualities and some bad tendencies. However, testing indicated that the bad tendencies came from a few degrees of dehidral and a pronounced twist I had built into the trailing edge. By spliting the trailing edge and twisting it I was able to correct most of the problems. After many practice flights I felt we were ready to try the Valkyrie against top notch competition.

I was pretty upset when at its first meet I was asked if it was a modified Nobler. Valkyrie placed third in its first two meets and then at the 1961 Mirror Meet won first by a one point margin with a 663 score. So that day I bought my wife a box of candy and a bouquet of flowers.

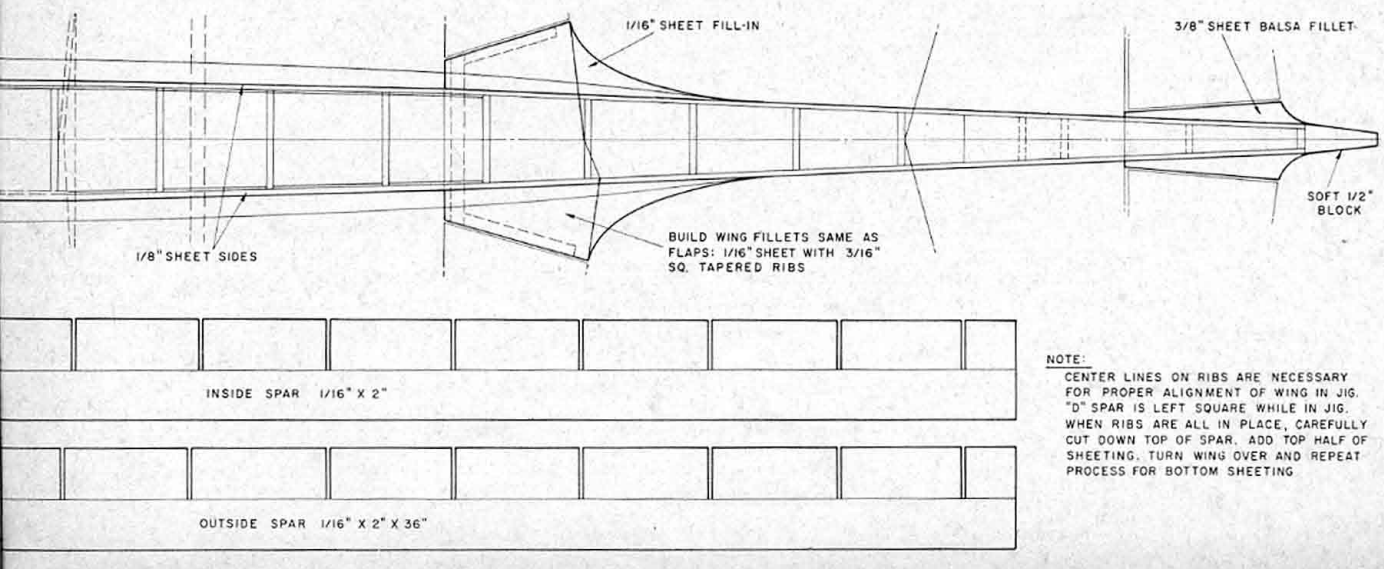
With the 1961 Willow Grove, Pa., Nationals in mind I began construction on a second Valkyrie. This time wing was constructed on a board instead of "up in the air". This was in a simple jig of one inch sq. blocks of balsa pinned down to the board. By drawing center lines on the ribs I was able to tell when the ribs were properly set up. With top and bottom sheeting glued on, you get a good wing. For two feverish months I worked on that new model. Its wings were covered with jap tissue, a new

Sybil Dupres (yes, lads, it's "Miss") at Garden State (N.J.) Circle Burners' annual Eastern States Invitational Stunt Championships with Crusader. Both real beauties!

built-up stab was included. The combination gave me a three ounce lighter model, a mere 44 ounces.

The job was completed just two weeks before the Nats and I was all smiles when I brought it out to Rich's Hobbytowne for test flights. After a successful first hop, on the second I was practicing wingovers after the pattern when the push-rod snapped. The plane dove in just as I was about to pull out of a wingover. Buried 4 inches in the ground it had to be pulled out like a javelin. Because of a recent rain the soft turf had cushioned the impact to a great extent. This plus good sturdy construction had saved her. The spinner had hit a rock a couple of inches into the ground and was crushed in on one side. As the spinner crushed, the bolts sheered taking most of the shock.

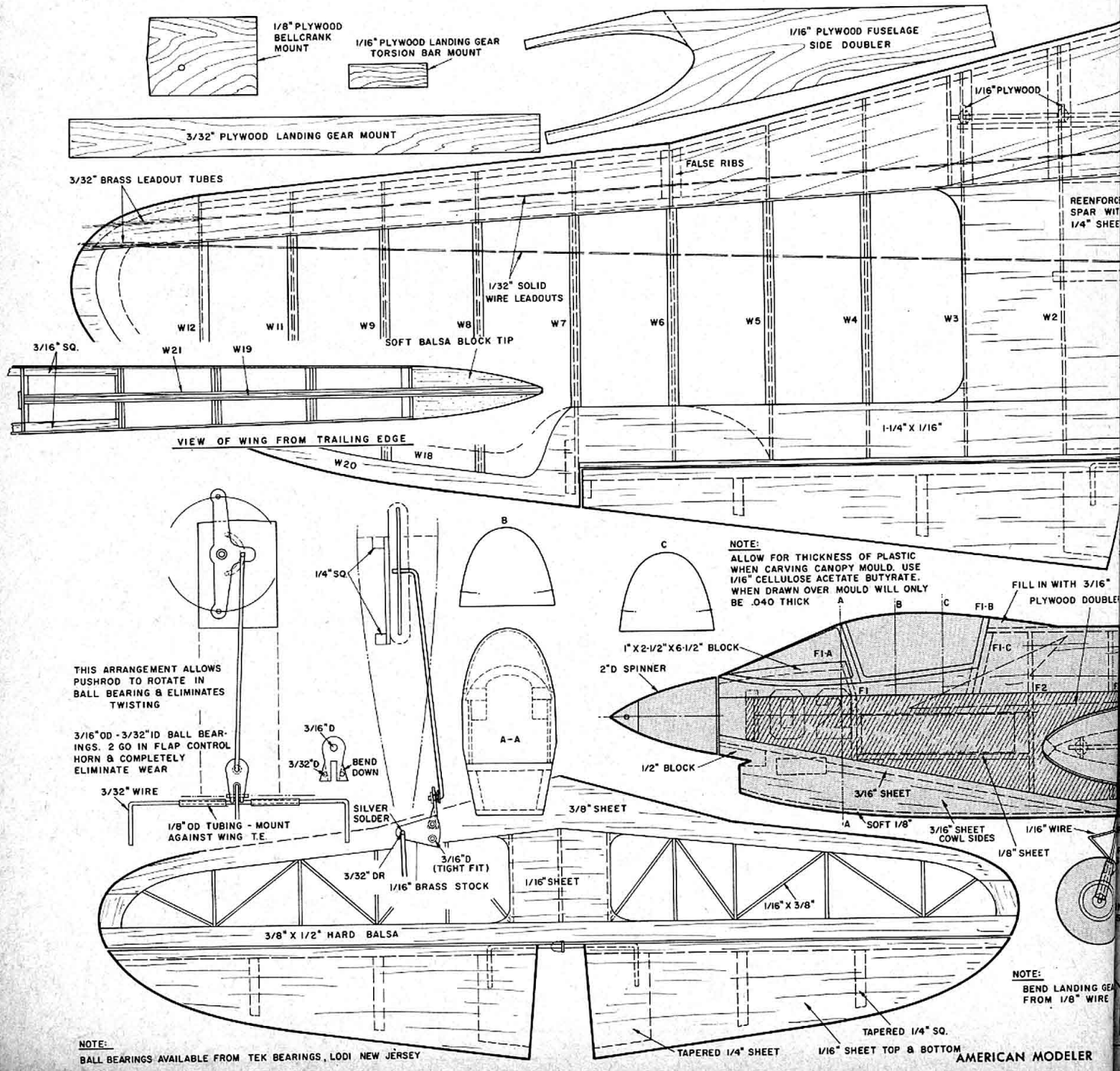
Nats' qualifying flights were flown in excellent whether and I ended the day tied with Lew McFarland for the high score in the circle. I had an idea he was the man to beat, so for the finals I watched his practice flights and made sure I would fly my flight right after his. Lew's first official was well along when he suddenly left out a couple of maneuvers. This put all the pressure on his second flight. My first attempt was not up to that of the day before so I, too, would have to depend on my second go-round. At the finish of



my flight Lew surprised me by immediately signing up for his last flight. Usually at a contest you will take a couple of test hops between officials, but I guess Lew felt that was the time. This was when I was in trouble. Should I practice or follow Lew? I chose to follow Lew. The pattern put in by McFarland was outstanding. As I fueled up for my official I knew I had my work cut out for me. During my flight I grew more and more confident, but as I brought the model out of the overhead eight and into level flight the engine suddenly cut. One of the tank vents had snapped flush against the side of the fuselage; fuel had leaked out causing premature cutout.

The first two Valkyries were flown for a year and a half and chalked up many contest victories. As the controls in both were starting to loosen up I was glad when the winter season gave me a chance to start out on a new Valkyrie. The original models had fuselage-mounted landing gear and only half-cowls on each engine. These were the first changes in the new design. I had in mind torsion bar landing gear attached to the wings. When the new wing was built these modifications were made.

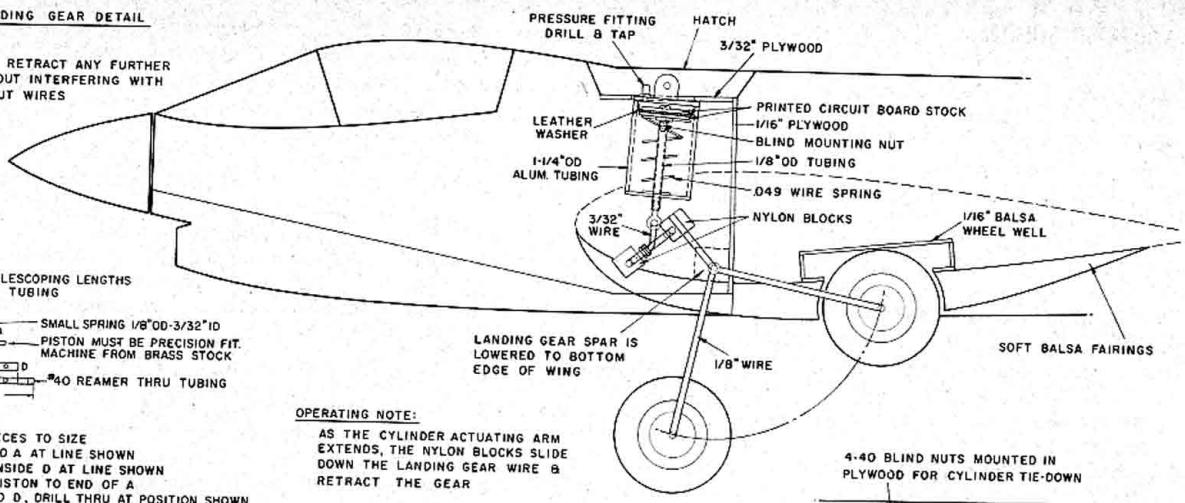
The control system was redesigned to include ball bearings in the control horns and a nylon bellcrank. These bearings, $1.50 each, are easily obtained . . . the control system is the heart of any model since you are constantly applying control. I get my bearings from Tek Bearings, 122 Essex St., Lodi, N. J. The cloth hinges on the wings and stab had to be replaced on both other models and I had considered nylon or metal hinges. However, cloth hinges are by far the easiest to handle so I decided to try and improve them. I treated three sets in a simple way, and left one set as you would regularly install it. In less than 20 flights the one set was gone—as for the others they are still going strong. I cut the hinges to size and lay them on a sheet of waxed paper. Using a filler paint you brush it into the hinge material. As it dries turn them over and do the other side. When they (*Continued on page 79*)



RETRACTING LANDING GEAR DETAIL

NOTE:

WHEELS CANNOT RETRACT ANY FURTHER INTO WING WITHOUT INTERFERING WITH CONTROL LEADOUT WIRES



VALVE IS MADE OF TELESCOPING LENGTHS OF BRASS TUBING

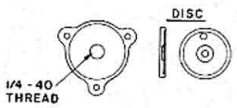
VALVE ASSEMBLY:

1 - CUT ALL PIECES TO SIZE
2 - SOLDER B TO A AT LINE SHOWN
3 - SOLDER C INSIDE D AT LINE SHOWN
4 - PRESS FIT PISTON TO END OF A
5 - SLIDE E INTO D, DRILL THRU AT POSITION SHOWN
6 - RUN REAMER IN E TO FIT PISTON
7 - SLIDE A INTO D, ADD SPRING AND SOLDER

OPERATING NOTE:

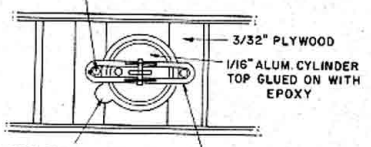
AS THE CYLINDER ACTUATING ARM EXTENDS, THE NYLON BLOCKS SLIDE DOWN THE LANDING GEAR WIRE & RETRACT THE GEAR

MACHINE FROM 1-1/2" ALUMINUM BAR STOCK



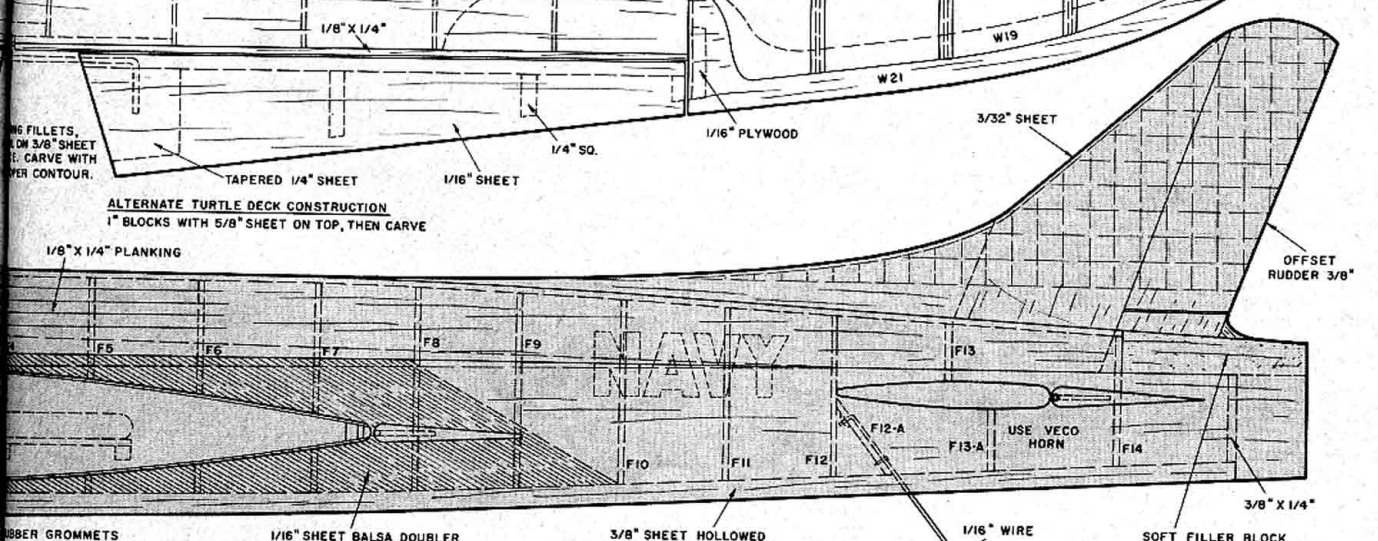
BACKPLATE DETAIL FOR FOX 35

4-40 BLIND NUTS MOUNTED IN PLYWOOD FOR CYLINDER TIE-DOWN

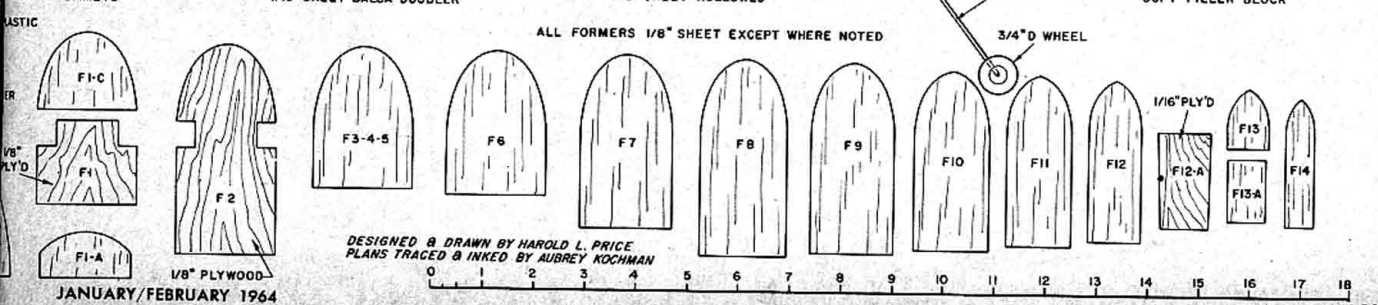


PRESSURE CYLINDER TOP VIEW

ALTERNATE TURTLE DECK CONSTRUCTION
1" BLOCKS WITH 5/8" SHEET ON TOP, THEN CARVE

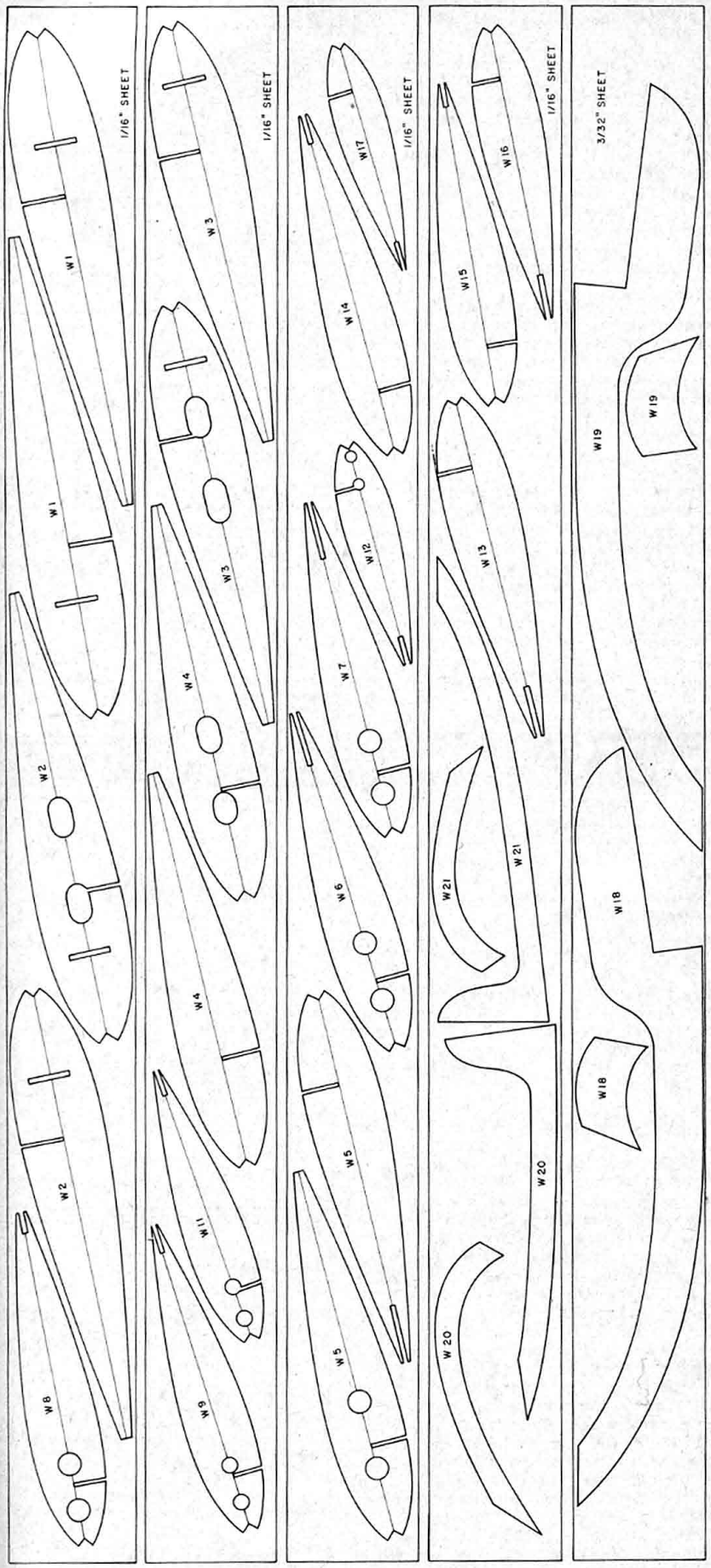


ALL FORMERS 1/8" SHEET EXCEPT WHERE NOTED



DESIGNED & DRAWN BY HAROLD L. PRICE
PLANS TRACED & INKED BY AUBREY KOCHMAN

RETRACTING GEAR CRUSADER STUNTER



Full size working drawings for the Crusader C/Line stunter are part of Group Plan #264 available from Hobby Helpers, 1543 Stillwell Ave., New York 61, N. Y. ($1.10)

Crusader

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are well dried apply to the wing and stab using clear dope. All hinges crack because paint gets between the hinge line and stiffens up the cloth in this area. Since you have pre-sealed the material you get flexibility when the finish is applied.

The first meet of the 1962 year was sponsored by the Union, N. J., Model Club. That day we took home first place. Tight judging and excellent field operation made this a really outstanding contest.

Those Chicago Nationals in 1962 seemed like an expensive trip, but after considering my chances I finally made up my mind to go. My plane was taken by car the week before the contest. I arrived by jet the morning of the qualifying flights and with little practice. It wouldn't have made much difference because the flights were flown in a near hurricane. I managed to get in the finals but it was a hard task. For the finals the weather was ideal and in the last few hours the top men put on some of the best flying I have seen in 12 years. In this high-class competition I was pleased to settle for 4th place.

During the afternoon I had walked over to the radio control area to photograph some of the activities (one of my other hobbies is 8-mm movie photography). There Harold deBolt was demonstrating his retracting gear radio job. Only then did I consider for the first time retracting gear in a stunt model.

The idea of an air cylinder to supply the power was introduced in *American Modeler* and in this I saw a possible answer. I would hook one cylinder in the fuselage center to two separate torsion bars from the wing gear. Since the torsion bars could be locked when the gear was down there was no weakening of the landing gear by installing the air cylinder The cylinder from aluminum tubing weighed slightly over one ounce and operated well on about two pounds of air pressure For a source of air pressure I tried crankcase pressure. I found that pressurizing directly into the cylinder from the crankcase also pushed raw fuel into the cylinder. Any loss of fuel could cause trouble, so the idea was discarded.

For a simple source of pressure it is hard to beat a single action pump and an .010 Cox was the smallest engine available for the job. A glo head was modified with a ball check and I tried it out in a drill press to see how well it worked as a pump. The little peanut gave me 10 pounds of pressure at about 7,000-rpm. Of course, there isn't much volume of air, but the pressure is adequate for the single cylinder. So far I had 2-oz and still no way of mounting the pump. The Cox crankcase, when stripped of its plastic air intake and prop washer has a very fine thread (¼-40) in the front. The engine shaft takes a 2-56 for the prop mounting bolt so this gave me the idea of mounting the engine directly in the rear of the 35 engine and running a disk off the .010 crankshaft. A pin in the crankpin would be the power takeoff. If you have ever seen the inside of a McCoy 60 you can see the picture. I put the idea into a set of working plans and talked it over with my brother Charlie. It is easy to develop

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Crusader

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an idea like this, but it takes a real machinist to get the first one to work. After some troubled nights in the machine shop I assembled the entire system in a bench test stand and started the engine. After about an hour of running I was convinced that the additional drag of the piggy back engine did not in any way interfere with the stunt Fox. A simple air pressure switch was designed to bleed off all the pressure from the pump when the plane was on the ground and then close off the bleed hole when the plane reached flying speed.

At this point with victory in sight I began installing the system in the unfinished model. Everything was made removable for ease of servicing. Originally the pressure switch was installed in the fuselage, but this was removed when testing showed it was affected by the prop blast. With the switch in the wing the gear gave the best results. Takeoffs are normal, then at airborne ½-lap the gear retracts smoothly into the wing. After the pattern the landing is also normal. With engine cutout your plane glides with the gear retracted until its air speed drops, then the gear quickly drops and locks into position. The effect on the maneuvers is most noticeable on the squares since you don't have the extra turbulence and drag of any landing gear to slow you down. The hourglass is another that is cleaner with the gear-up.

The change in trim is not so obvious as in the first test flights during where the model was slightly tail heavy. It required one ounce of nose trim to smooth out. Overall weight including this nose weight and retracting gear system was 49-oz, just 2-oz over most other models and it made no difference in its flying characteristics. I am sure this model could handle 10 ounces more in weight and still do well. However, you would have to go to a 40 or 45 engine.

This retracting system could be easily adapted to a scale model. When compared to other ways of using motors, gears, batteries and complicated pushrods to me it seems most simple. The main problem in any retracting gear is the fail-safe feature. If our Crusader is not up to air speed its landing gear stays down. The pressure switch is set to operate at 30-mph which is 20-mph below the minimum speed of the model. To set it up I built the switch on a breadboard and then took it for a ride in my car. When we hit 30-mph I put it out in the slip stream of the car and adjusted the lever bar until it just closed. And if a pressure line pops off the gear drops and stays down for the entire flight. Most of my initial problems were caused by poor cooling of the pump engine. The addition of air and oil vents for the .010 was the answer.

Flying the Crusader I have qualified for the FAI Finals in Chicago with a top place in an AAA meet. This was the first meet for the Crusader and much of that victory must go to the good impression left with the judges when the plane was judged for appearance. It was a very windy day (as usual) and the expected expert competition was present. While some others bobbed all along the way the Crusader buzzed cleanly through the pattern as if there was no wind at all. One comment which the judges made that I remember, "The Valkyrie flew well, but the Crusader is more impressive". Since then the Crusader has placed in the six meets it has been entered winning 3 firsts, 1 second, and 2 thirds. Although not always first, no one ever overlooked the chance to see its retracting gear operate. I have never been accorded less than maximum for "realism" and have gained top "appearance" points in all contests entered.

Construction. A careful study of the plans will give you an idea of the simplicity (honest!) of the design. I have found it best to begin with the wing, then start rest of model while wing is drying. The reason for this is simple. The longer you let the wing dry the stronger construction will be. The building surface for the wing must be 60 x 18 inches. It may be necessary to piece together narrower 60-inch lengths to get the 18-inch width—this is okay as long as the board is flat. Cut 1 x 1 x 36" balsa into one inch block and you are ready to set up jig. Lay waxed paper over the full-size plans and locate the blocks using two at each rib station. Large pins or nails hold blocks firmly in place. Cut ribs from 1/16 x 3 x 36" Sig balsa which weighs not much more than ½ ounce per sheet.

The selection of balsa for the ribs and sheeting is very important in this wing. D-spar is rock-hard balsa trimmed along its edges to bring it exactly straight. Set up spar in jig without taper. This taper is added after all ribs are glued to the spar. Fit ribs into spar with centerlines running through both rib and spar. The blocks will hold individual ribs so don't glue them at this time. Since it is very hard for anyone to be perfect, if a rib doesn't look right take it out and check it. Cut wing trailing edges and fit into rib slots but do not glue. Block up T.E. so it aligns perfectly.

The wing now looks like a giant jigsay puzzle. Glue nothing until the control system layout is placed in the center section. Cut slots for the plywood landing gear brace and slide plywood into ribs. Open up center section and add ¼ sq. balsa braces. Start gluing from center section out. I use Elmer's glue on all spar joints and Ambroid on all outside joints. Go over spar joints with white glue until each one is evenly covered. Locate leadout holes and add all "D" spar doublers at wing sheeting breaks. Cut spar top down carefully to conform with ribs. Apply leading edge sheeting starting at leading edge and rolling sheet back toward spar. Center section sheeting must be from same sheet as leading edge or it will sand differently.

While wing top is drying do the trailing edge, carefully checking centerline to keep it true. When sheeting is dry, turn wing over so leading edge is now at the other side of your board. Pin it back down, re-checking to see that all centerlines are right. With the wing in the jig, complete installation of landing gear. Set rubber grommets in 1/16" plywood, cut slots in ribs to accept wire. Add 3/16" sheet false ribs from the inside and glue liberally. A false rib at the end of the landing gear wire of 1/16" plywood keeps gear in place yet allows it to flex back and forth. Add false ribs at all butt joints to reinforce glue joints. Add bottom sheeting same as top and allow to dry well. With wing still pinned down add capstrips, tips, and hollow blocks.

The use of sand paper on the bare wing wood will make a big difference in its final appearance. Be careful not to sand too heavily on the cap strips. Use a sandpaper block with care. The leading edge is rounded with a small plane; when you are sure the radius is constant, sand leading edge. I have spent as many as 8 hours sanding one of these wings. The result was a perfect base for the paper plus a full ounce saving in weight. Before the covering is applied brush 2 thin coats of filler into the wood to fill the balsa pores.

My filler is made by taking small baby food jars and mixing in the following proportions: 4-oz dry talcum powder, 4-oz thinner, 4-oz clear dope, 2-oz of the color you plan using for the finish coats. First mix the thinner into the talcum powder, then add the other ingredients. As you sand between coats you see how quickly the open pores of the balsa fill. The small amount of color dope will tell you exactly how far you have sanded. Apply medium Silkspan wet, use clear dope for adhesive. After the paper dries give it two coats of clear to seal the open areas, then, using the same mixture of filler, apply the filler coats to the wing.

If you can use a spray gun at this point it will give you a finish with no brushmarks. Each successive coat of filler must be well sanded with wet-and-dry paper before the next coat is applied. I prepare the wet-and-dry by soaking it in hot soapy water for an hour of so. While the wing filler coats are in process begin the rest of the construction. The stabilizer is assembled over the plans and allowed to dry. Fuselage sides are cut and plywood doublers and motor mounts are assembled. Use a standard 3.5-ounce stunt tank in the fuselage with both vents modified to come out below the plywood doublers. Try sliding the wing into the fuselage cutout to determine where you will have to cut the sides to get your landing gear into place. When you are satisfied the wing is exactly on centerline glue it with Elmer's. Add fuselage doublers and formers and glue in stab.

I find it a good practice to make up a list of opeartions in order of importance and then try to get at least one or two details finished during a building session. Much time can be wasted repairing building sequence mistakes if you don't plan each operation before tackling it. The finish of the models I have built were all sprayed from filler coats to the final coats of clear. This requires a little practice, but does make a difference in final model weight.

One detail which does a lot to dress up the model is its canopy. If you want a duplicate of mine send $2 to Supercraft Models, 174 Main St., Ridgefield Park, N. J., and you will get one formed of heavy plastic.

Performance will depend on your engine and its power so if you build heavy be sure to have a hot 35 or 40 in your Crusader. If the model is too slow it will not give you the performance expected.

Bullet

(*Continued from page 42*)

time. The original wing panels had been cannibalized so that their parts and fittings could be used in the new wing. And now it was too late to start construction of another straight wing.

Ed decided to take the ship to the Nationals at Cleveland in its "improved" condition anyway. He might not be lapping the field this time, but his Bullet was still fast. The ship appeared there sporting a new paint job, maroon with