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THIS MONTH

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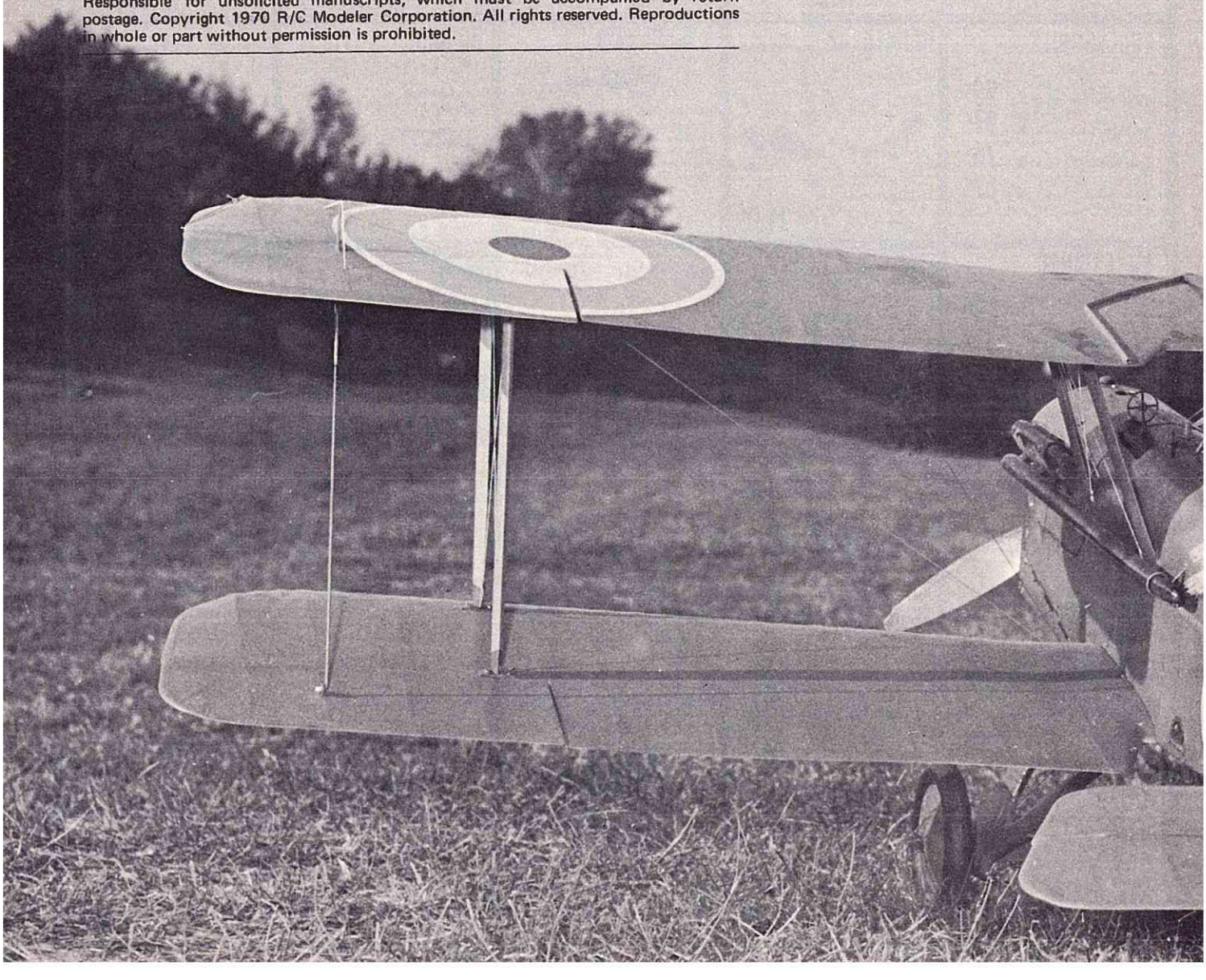
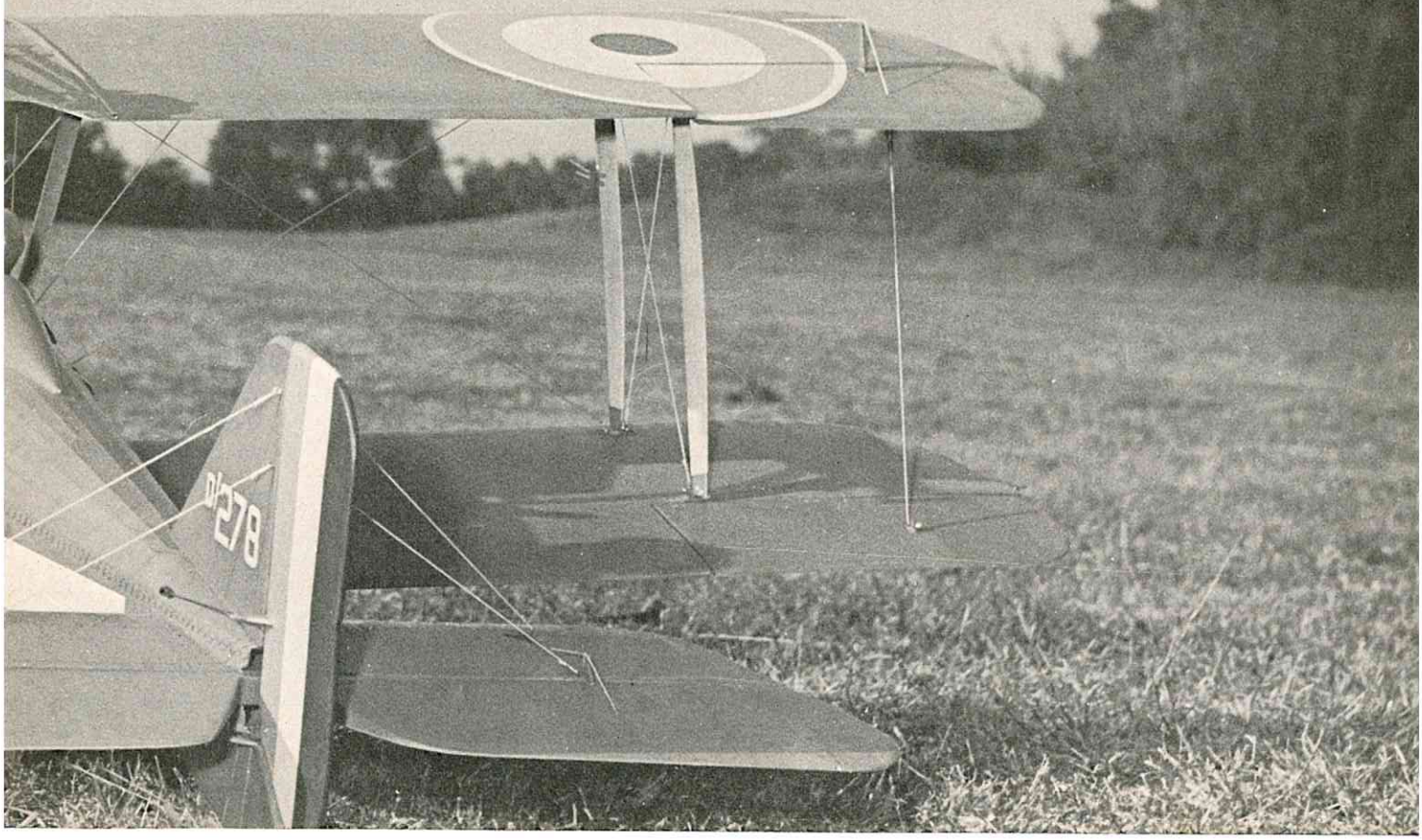


COVER: Patrice Leary, Carol Phipson, and Judi Griggs, members of the cast of the world famous Holiday On Ice Show pose on location with three Product 60 Hobbies ARF's. Type C color print by Stan Orlob.
FRONTSPIECE: "Dawn Patrol" photo by Bill Coons. Model is Top Flite SE-5 by Josh Titus.



VIEWPOINT

BY DON DEWEY

By BAKICI

If we stop and think for a moment we will realize that while some of us go out to our flying fields to engage in competition, many of us – and probably the majority of us – go out to the field for outdoor recreation. Among the things we want and need there are: pleasant surroundings, sufficient quiet to make it pleasant, other recreation facilities for our non-flying families, proper restroom facilities for ourselves and our families, water and cleanup facilities, and above all – reasonably safe conditions for all.

As the competition for recreation space continues in our increasingly off-duty society, every new modeler strains the existing facilities. It is not unrealistic to expect that within five years we may have as many as one million persons wanting to be active in radio control modeling. We cannot even hope to handle that many people with the present or projected facilities. We should also expect that a considerable portion of these recreation-bent aeromodelers are not, or will not be, AMA members. They will only join such organizations as they must. But – these same persons will want to use the public recreation space and will want to use the allotted frequencies. Without a reasonable degree of enforcement or even "policing" power, the established flying sites will simply become untenable. The recent news from Memphis, Tennessee which tells us of persons who spent their summer "shooting down" model aircraft with their transmitter is enough to let us realize that we need local enforcement authority.

While we concern ourselves with control of our flying sites, we should also begin a very careful study of the matter of those flying sites themselves. As it now stands, individuals and clubs go out and fend for themselves to obtain sites. Again, this is really adequate for the situation up to now, but when radio airmodeling becomes really big-time recreation, this method won't work. On the other hand the municipal, county, state and national recreation authorities are more than willing to consider the various recreation needs of the citizens of their jurisdictions – providing someone shows them the need. And, of course, we all know that we still find a lot of people around who have never heard of us.

What this all demands is – organization. While our AMA is doing a good job for the organization of the individuals who wish to join, they are geared for coordinating individuals and clubs on the competition scene. They are not geared for the application of coordination and cooperation at the local scene, nor to develop the rapport necessary between the local modeler and his local authorities.

We do not doubt that in time AMA will be able to help us with the local problem, but the point is that we are now about five years behind on the local political scene in competing for recreation space and in getting the cooperation and assistance of the local recreational authorities. This sort of work takes intensive organization and local work.

Anyone who works with the local park, recreation and similar public institutions soon gets to recognize the fact that these organizations want to talk to people who are the official spokesmen for a large portion of their jurisdiction's population. The president of a club of 50 members just doesn't stand a chance against the spokesman for five thousand families – as witness the takeover of club flying fields by Little League.

The inevitable conclusion of the above is that the willing workers for our clubs must double or even triple their club workload! They must set about to form associations of clubs on a municipal, county, state or regional basis. The organizations so formed must stand careful scrutiny as to whether they are or are not truly representative.

Then, the official representatives of these local associations must begin the most intensive of public relations and local government relations programs. Every effort must be devoted to convincing local community service clubs, fraternal orders, and whatever other organizations that exist that aeromodeling is in the best interest of the community. Then, with the backing of these other organizations, the local authorities must have presented a plan for action. They must not simply be sought by supplicants. They must be presented with solutions to their problems! Their problem, of course, is: "How best to satisfy the recreation needs of our community?"

The aeromodelers recreation plan must also include specific means by which the activity can be policed. To leave the policing of the activity to a local club or even association of clubs will not do. The clubs will not be able to cover the areas 24 hours a day and seven days a week. Park Police Instructions, and instructions recognizable to other authority must be issued. Notices and regulations by appropriate authority must be posted by that authority. Club notices will be disregarded by non-members.

So, fellow aeromodelers, let's get to work! We need local organization. Let's make local organization! The AMA will help us. It has quite a bit of good advice to offer right now. So, under the AMA general banner, but guided by our own needs, let us have truly democratic local action and organization! ●

G. E. M. S.

BY THE JIMS

GENERALIZATIONS EFFECTING MODELS

JIM SIMPSON & JIM BONAR

Let's suppose you are overseas somewhere and you have ordered and received, for example, via air mail from a stateside company, a Lanier Comet airplane and a Classic radio system. You did the unexpected and read all the instructions through until you completely understood them, then started assembly and installation and, now as you stand behind your craft with the radio on, you move the left stick forward or up and the carburetor barrel opens. Good! You move the same stick left and the rudder moves toward the left and if you hold it left and then push the plane it turns left. Good, good! Now move the right stick right and hold it. Is the right aileron up and the left one down? Good, good, good! Move the same stick forward or up and the elevator went down? Good! Is the balance point where it is supposed to be? 1/3 back from the leading edge of the wing? Does the engine run a whole tank of gas out without slowing down or quitting? Fantastic! You are nearly ready to try it. If you don't understand the principle of flight go to the library and get a book about flight principles or get a pilot to explain them to you.

Now, this might come as a surprise to you "doubting thomases" who are doubled over with glee, but two things are apparent here. First, when you next go to your well-attended flying session or club meeting ask the newest flyer there to explain the basics of flight to you. Did he say wind blast against the exposed surface pushed the tail around or did he explain that unequal pressures cause the surface to move into the low pressure area? Heck no, I won't tell you which is right. Go get a book about flight and read it yourself. There is no difference in the principle as applied to big or small planes. The only difference is quantity.

Secondly, besides not understanding how their planes fly it is just as easy, or sometimes more so, for a modeler in a remote part of the world to get a pilots help than for you in the good old USA to do so. As a matter of fact, the guy in equatorial Africa may have gotten where he is by plane only. No matter! The important thing is **before** you fly **know** how your bird works. We would gladly paraphrase any of the great books already written on the subject but would rather write about some things which are not yet in print, so on we go.

You must pick your flying site. The ideal site is an abandoned airport or runway, roadway, or otherwise smooth, preferably paved (so your prop doesn't throw rocks) flat area, free from obstructions! Unfortunately what we generally settle for is much less than that. You must consider the wind and, if at all possible, at least the approach and departure ends of your runway must be free of hazards. Know why we didn't say obstacles? Well do you know what a 'klong' is? OK, it's a word used in Thailand to indicate a dirty, fast-running, wide, deep canal sometimes bordered with jungle, snakes, insects, etc. The place provided for model flying a U-Tapao Airfield on the Gulf of Siam is bordered on three sides by such a hazard! Then for sport the fourth side has a sign, two sets of bleachers, and a bunch of trees as obstacles which stick way up in the air and have a magnetic attraction for all beginners and most experts' planes! The klong was entirely below the level of the field but, nevertheless, it claimed two airplanes in less than two months! So pick your site with the idea in mind that you may have to go a ways to retrieve your wandering bird.

When you find a site and your plane is ready you will find that the closer you get to takeoff time the more nervous and upset you become. This condition would be natural if everyone was affected by it. Some people are as cool as cucumbers at this stage. It took me fifteen years to discover the secret. They are either rich enough that 500 dollars doesn't mean anything to them or they don't give a damn! If you are still nervous, or feel the pressure of a possible loss of your investment, you must either forget about its material value or become as methodical and infallable as NASA because the odds are as great against you as they were against the Apollo Mission! Either way, you must remember that any pressure or

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CUNNINGHAM ON R/C

Thanks Chief! Chuck Cunningham and Pat Crews view the remains of a 'Miss Bikini' after a flight by RCM'S Editor.

As you read this issue of RCM, Spring is beginning to be felt all over the country. With the coming of Spring the thoughts of many winter locked fliers begin to center more and more on getting out to the flying field for that first flight. Perhaps all Winter has been spent deep in the cellar working on that new bird, and getting it ready for it's first journey into the wild blue. The aircraft may be ready, but is the pilot?

Most of us that labor at the typewriter each month for good old RCM, and Unkie Donnie, live in the warmer parts of the country and most of us can get to fly almost all year around. Sure, we're lucky, and spoiled too for that matter. It's easy to chalk up a lot of experience, and flying time when you can look forward to almost every weekend being passable enough to fly. This morning, as I write this column, it is early January and the country has been gripped in a "deep freeze" for the past two weeks; but this morning the hold has been broken, the sun is shining, and the temperature is to move to near seventy by midafternoon. So what if the Super Bowl is on, spectating in front of the tube can't equal the joy of chasing a radio controlled aircraft about the sky. **Doing** is a lot more fun than just watching. My stable of aircraft has not grown during the past year as I wished, not due to crashes, but simply due to not having enough time to design and build all of the aircraft that I have stuck away in the back of my mind. But, with a reasonable stable of well proven aircraft, expectations are always good that when I **do** get out to fly the time will be spent in **flying**, and not in tinkering. Which, by the way, brings me to the subject of this diatribe. It's more fun to fly than to spectate, be it looking at the boob tube, or standing on the other side of the fence watching someone else fly. If you've had all winter to get ready for a spring and summer of flying, are you really ready?

I was reading in one of the northern newsletters the other day about some poor chap that had taken a year to complete a Senior Falcon. Something happened to it, the newsletter didn't say just what, and now he had just five months to get something ready for the spring flying. This is just the point. If you are not an experienced flier, or an experienced model builder you may spend an ungodly amount of time getting ready for your flying season only to see it all go down the drain in one massive crunch. Perhaps the aircraft was really okay but your flying was either rusty, or you were not experienced enough to handle that particular aircraft.

It's not a bad idea, after a long winter layoff, to start the new flying season with a tried and true aircraft. It should be one that you had been flying the season before; one that you know will fly, and just what its problems are. Nothing is better for a pilot than instant reflexes, so that the conscious mind doesn't need to be engaged in order to obtain the right answer. These reflexes take time to develop. They can certainly diminish in a few short months. I know that this past year has been such a

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SUNDAY FLIER

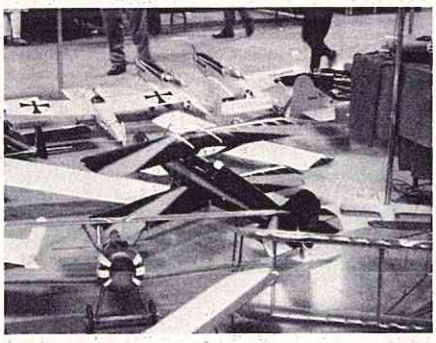
KEN WILLARD

For the fourth year in a row, the Garden Grove R/C club has come to bat with their annual trade show and made a hit – although some of the exhibitors may figure it was a scratch hit because of the relatively short notice. For a while there was some doubt as to whether the club would be able to put on the show this year, and then when the green light came on, it was pretty late in the game for some of the exhibitors, and they had to scratch around pretty fast in order to arrange their schedules.

But the show did go on, and it was a good one for the modelers. There was a variety of R/C wares, some new items, and some good flying – although the rain on Sunday cut it short. From the exhibitors standpoint, the crowd wasn't up to expectations (even though it was large) and the timing was bad in two respects. First, you shouldn't have a show when the Super Bowl is scheduled (the same thing happened last year) and second, one hour between closing time and the social hour, for the banquet isn't adequate – especially if the banquet hall is some fifteen miles from the motels.

But modelers could care less about crowd statistics and show logistics. They came to see the show – and it was worth it.

Picture number one shows the crowd on Sunday. Maybe it wasn't as big as last year – but it was just as tough to get close to a booth, especially the popular



ones.

Picture number two shows a part of the real center of attraction to the general public – the sleek models. As always, the workmanship on these beautiful jobs defies description.

The weather wasn't satisfactory for pictures of the flying, but that didn't stop the demonstrations. I wasn't able to see them all, but Paul Sherlock's LearJet and Top Flite's Nobler, modified by Ed Sweeney to include a retractable gear, put on a couple of the best flying demonstrations ever given at the MATS.

Now to get on to the exhibits. I've grouped the pictures alphabetically by exhibitor in various categories. Space doesn't permit a lengthy discussion of all the items – and in some cases maybe the people are more interesting than the product. You be the judge.

RADIO EQUIPMENT

(continued on page 71)

ENGINE CLINIC

BY CLARENCE LEE

Since starting this column a year and a half ago I have done articles and occasionally given answers or made statements that I was sure would bring in a barrage of letters in rebuttal. Strangely enough, this has very seldom happened. Occasionally I will get a letter from a reader who is 'bent' about something, but not as often as you might think – up until the January issue that is! In this issue of the Engine Clinic I really stuck my foot in my mouth with an answer to a letter that I realize now was pretty stupid. The letters are still coming in setting me straight.

The letter that brought all the response was the last one in the column from a Major Lemieux, regarding torque and gyroscopic precession. In a previous article on checking the torque and horsepower of our model engines I had said that torque was the culprit that caused the airplane to change heading during take off and during loops, etc. Major Lemieux wrote in to say in a very lengthy and technical letter that it was not torque, but gyroscopic precession that caused the aircraft to change heading during a loop, and prop wash on the rudder that caused the direction change during take off. Major Lemieux also said that torque was a simple function of engine displacement and its brake mean effective pressure. The latter being dependent only upon the efficiency of the intake and exhaust ducting, and valve efficiency. I fired back an answer that torque was a simple twisting motion and that displacement, efficiency of the intake and exhaust ducting, or other points that the Major brought up had nothing to do with it. I know better than this and should have clarified my statement a little further. I am afraid that the thought I had in mind, and what came out in writing were two different things.

As most of you know who have taken engineering courses or had any amount of Physics at all, for every action there is an equal and opposite reaction. If you were to measure the amount of the resistance of this opposing force you would have a torque reading. Any time you have resistance to a twisting force, you have a torque reaction. This is the principle of the torque wrench used to tighten bolts. As the bolt tightens it sets up an opposing force, and this resistance is measured as a torque reading in foot pounds. The same thing occurs in a model airplane. In our case it is the tendency for the propeller to stand still and the airframe revolve. This will happen whether you have an internal combustion engine or a rubber band for power.

The Major was associating torque with the power output of an internal combusiton engine only. I was looking at it from the physics standpoint as a twisting force not necessarily related to an internal combusiton engine. This was my thinking when I made the profound statement to the Major that torque was a simple twisting motion, and that displacement, intake and exhaust ducting, etc., had nothing to do with it. Displacement, valve efficiency, carburetion, cam profile, etc., all DO have an effect on the B.M.E.P. and torque out put of an internal combustion engine.

Believe me gang, I am well aware of the affect of the above functions on the B.M.E.P. of an engine and its torque output. I started hopping up Model A Fords when I was 14 and used to run my car through the time traps set up at Muroc dry lake here in California in the late 30's and early 40's when 'hot rodding' was just getting its start. Muroc is now part of Edwards Air Force Base. I have been working with automobile engines ever since and have ported and relieved many an old flat head Ford block. For you non automotive types, this means to enlarge the intake and exhaust ducts or ports, and remove metal from around the valves themselves for better breathing. I used to grind my own camshafts for higher valve lift before all of the commercial grinders got into the act. Winfield was the only one in those days. For me to infer that displacement, valve efficiency, etc., had nothing to do with torque was a blunderous statement, and I hope that the technical types will forgive me. I do know better.

I hope that you fellows will realize that this column has to be done in spare time. I still have to work full time at my regular occupation. I also make no claims to being any great literary genius. I'm just trying to conduct an interesting column and pass on some of my findings over the years. So if I pull a goof or use a wrong choice of words now and then, you will have to bear with me.

I would like to apologize to the Major. I am sure that 'Clarence Lee' is a dirty word in the Major's vocabulary about now! I also wish to thank the Major for providing me indirectly with the material for this months column.

Now we come to the gyroscopic precision and prop wash on the Rudder bit that the Major brought out. One of the readers who wrote in – Ray Wille – brought to my attention a book that was written in 1944 by Wolfgang Langewiesche titled "Stick and Rudder", and published by McGraw Hill Book Co., New York. Chapter eight is titled "That Thing Called Torque". This chapter would certainly substantiate the Majors statements and alter my thinking. It even tells why some of us old Air Force types were taught what we were, and how some of these possible misconceptions came about. Of course this is Mr. Langewieche's theory, and can be disputed by others. I found the chapter very interesting reading and had wanted to print it in the column this month. However the book is copyrighted and permission has to be obtained from the author. I had written to the publishing house, who in turn were contacting the authors agent for per-

mission. The reply has not been received as of this writing and this column is well past its deadline. For the technical types who would like to pursue the gyroscopic precession, circular airflow, etc., theory further, I recommend you head for your local library and get a copy of "Stick and Rudder".

I received letters from Aeronautical engineers, flight instructors, Physics professors, and even one from the Office of the Dean, University of California at San Francisco. Some of the letters were less than complimentary. It seems as though there are a lot of people with axes to grind just waiting for the chance to jump on a soap box and sound off. I couldn't possibly run all of the letters I received, so will give you a sampling of those that did not chew me out too badly. As you can see, there are opposing ideas as to what makes an airplane turn left on take off.

The first writer attributes the left turn entirely to side wash or 'prop blast'. The second and third to the 'P' affect. The last to the Majors gyroscopic precession. As for myself, I still think that the tendency for the prop to stand still and the airframe revolve, especially when driven by 1000 or more horses, is putting one big load on the left wheel. The increased load increases the rolling friction. This is bound to be playing some part. However now that the 'P' affect has been added we are getting over my head. You guys can make your own decision!

Regarding your column in the January 1970 issue of RCM, I have the following comments on Major G. Lemieux's letter and your reply.

To start off, I would state that I substantially agree with Major Lemieux. However, if I may be permitted to elaborate on his statements, some of the confusion may be cleared up. The specific points are as follows:

1. The engine torque which drives the propeller has an equal and opposite reaction which causes an aircraft rolling moment (moment = torque) to the left when viewed from the rear. A slipstream rotation or swirl behind the propeller is produced with represents the aerodynamic reaction to the torque applied to the prop. This swirl causes a left to right sidewash at the vertical tail (for tails above the fuselage; right to left for tails below) which in turn, produces a lateral force on the tail to the right and, consequently, a yawing moment to the left. The lateral force due to sidewash also tends to compensate for the aforementioned direct engine torque reaction rolling moment to some extent. The lateral force is applied at a point above the roll axis and, therefore, produces a rolling moment to the right.

At a given flight condition and power setting, the pilot normally trims out these rolling and yawing moments via aileron and/or rudder. Should the pilot change power setting or speed (by climbing or diving) the trim setting required will change accordingly due to both direct torque reaction and tail sidewash changes.

Opening the throttle on takeoff causes the aircraft to veer to the left as described by Major Lemieux in accordance with the sidewash effect described above.

The above described effects are exactly reversed on British aircraft, for which the propellers rotate in the opposite direction. Much to their horror, many American pilots found this out in British aircraft during wild takeoffs occuring after cranking in nose-right trim prior to takeoff (as is the practice in their native aircraft) whereas nose–left trim was really needed.

2. Gyroscopic torques can be a factor in generating yawing and pitching moments, but only during maneuvers when the aircraft is rotating in pitch and/or yaw (as in turns and loops). The effect becomes more pronounced at low speed and high power settings. High powered aircraft with low wing loadings typically feel the effects most strongly.

In effect, the propeller shaft represents the spin axis of the gyro. If nose-left rudder is commanded, the aircraft will tend to pitch nose-up. Conversely, if nose-up elevator is commanded, the aircraft will tend to yaw nose-right. All of the foregoing is for American-type clockwise prop rotation when viewed from the rear. Moments in the opposite direction are generated by British convention props.

With respect to your reply to Major Lemieux, the TORQUE delivered to the shaft of reciprocating engines is most assuredly the DIRECT RESULT of the cylinder mean effective pressure acting upon the piston over the cycle of the engine. If you hold on to the crankcase of the engine, as in a dynamometer test, the reaction to this torque is felt. Such is the case in a dynamometer check of the horsepower of an electric motor; the REACTION to the direct TORQUE delivered to the shaft as a result of the electromagnetic armature forces is what is really being measured.

Veering to the left on takeoff can be attributed almost entirely to the previously mentioned sidewash or "prop blast" on the vertical tail. This sidewash is a direct RESULT of engine torque but direct engine torque applied to the aircraft is NOT the offender. The direct engine torque applied to the aircraft through the engine mounts can only produce an aircraft rolling (not veering) tendency during takeoff. This rolling tendency is counterebalanced during takeoff by a combination of natural landing gear wheel reactions and moderate pilot aileron inputs.

I'm sure that gyroscopic precession played no great part in producing P-51 left-veering tendencies during takeoff. Incidentally, while my R/C flying experience is not great, I have not noticed any significant indications of gyroscopic precession during maneuvers, — and I have been flying relatively light, highly powered models.

I hope that my comments have provided some clarification. I have enclosed a copy of this letter which is intended for Major Lemieux. I would appreciate it if you would send it on to him, since your column did not include his address.

Yours very truly,
Robert W. Kress
Huntington, New York

I'm not saying torque, gyroscopic precession (??) or the velocity of the slipstream passing by the vertical stabilizer do not cause the aircraft to turn left, but what about "P" factor?

The drawing will probably explain this better than I can but what it amounts to is this. At a high angle of attack, the starboard prop blade has much more thrust with relation to the direction of travel. In the diagram the port blade is actually con-

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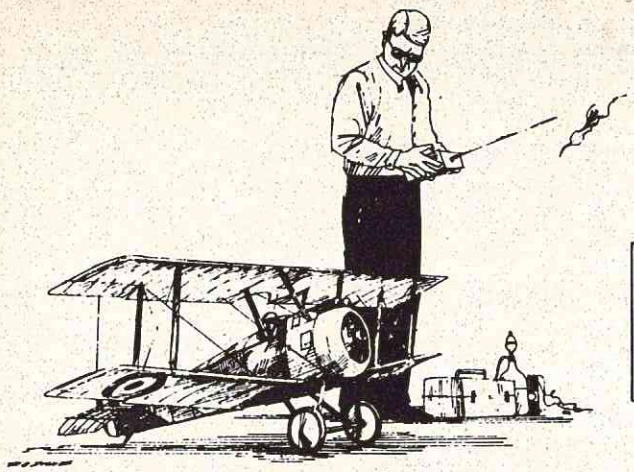

by DAVE PLATT
(Designer — Top Flite Models)

SCALE IN HAND...

I have been experimenting with retracting landing gears in RC Scale models for many years, and several times have made a fool of myself in public with setups that didn't work properly for one reason or another. Let me offer the following thoughts on this thorny subject, based on untold hours of frustration, embarrassment and bitter experience.

First, do not be mislead by the apparent ease of getting retracting gear setups to work reliably in sport or pattern type RC models. It will not be so simple in a scale model, because:

a) Legs are longer (and therefore heavier).
b) Wheels are larger (ditto).
c) Doors must close up – a nicety not found on the average pattern model.
d) The model weighs more, causing greater strain on the legs and down-lock than a light RC job creates.

therefore, that which is satisfactory for the non-scale or semi-scale model may not, and probably *will* not, be satisfactory for a scale model. The energy required for reliable retraction and the strength needed for continuous operation are enormous – don't ever forget it.

In order to make a tidy presentation of the facts and opinions herewith, I am going to first itemize the various important aspects of retract-LG design, and then discuss each one in detail.

1) Balance
2) Prime movers
3) Locks
4) Leg strength
5) Geometry

Alright, let's start with No. 1, *Balance*. Regardless of the design of the rest of the system or what prime mover will be used to drive the legs, the leg/wheel combination must be balanced. By this we mean that the weight of the gear must be offset by some compensating force, as nearly equal to that weight as possible. The usual way of doing this is with a spring, as typified by the K.D.H. (Technisales) unit. However, in this case, the spring only ASSISTS the leg, it does not BALANCE it. Unless the manufacturer had definite knowledge of the actual wheel and length to be used by the purchaser, he obviously could not arrange a balanced system. In any case, the spring in this unit is incorrectly placed for a true balanced system. For pattern jobs, it doesn't matter, as we said. But we're talking about Scale.

To balance a unit correctly we must have the leg installed, hinged, and free to retract. The wheel, landing gear "dressing", and door(s), if any, must be on. In other words, all weight must be present at this time. See Fig. 1, which shows a balanced set-up. Solder the arm (A) onto the rear of the leg and run a spring (B) to some fixed point (C) out in the wing.

The system works as follows:

When the leg is "DOWN", the first several degrees of retraction will take very little power. The spring will supply equally small compensation. Gradually, as the leg rises, the power requirement to continue the retraction increases. The spring's force likewise increases until, at the last few degrees, where the leg is very "heavy" and the force required to move it runs into several *pounds*, the spring is really working to provide equal compensation.

How does the spring's energy change proportionally to provide the correct compensation? It does this by proportionally increasing its own sideways moment as the arm A rises relative to point C.

It is up to the builder to obtain the right placement. By varying the tension on the spring and the distance of its attachment point from the LG pivot (along Arm A), a certain level of equilibrium is achieved. This usually takes an hour or so, to get "just-so."

When the spring placement and tension are correct, the leg (uncoupled to its prime mover) can be pushed anywhere from full 'down' to fully retracted, and just stay where it is put. (Rather like a propeller in balance.) The first leg takes awhile to get right, as we have already admitted. The second one takes 5 minutes!

2) Prime movers. The prime mover, or movers, is the little bundle of energy we are going to use to do the pushing and pulling. It could be a servo, electric motor, a clockwork motor, or even a *rubber* motor! I've tried them all. Eliminating the most useless ones first, we find that rubber takes too much space, needs winding after each flight and is generally a messy and archaic idea. These considerations wouldn't be so terrible if there wasn't a better way,

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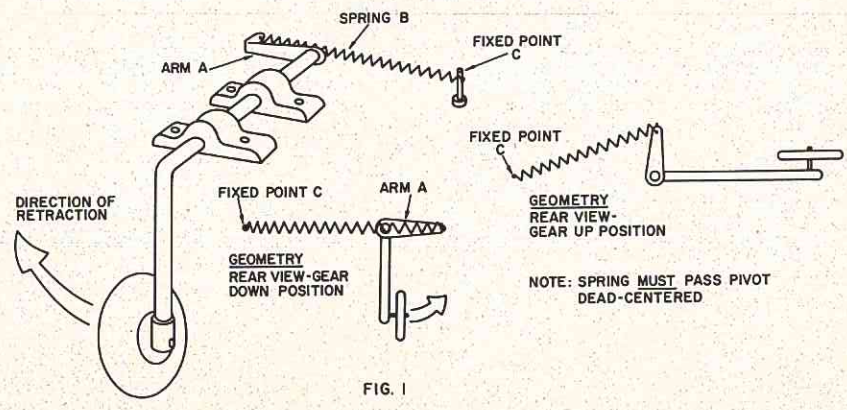


FIG. 1

the graduate

Have you been flying high wing planes? Do you want to fly low wing planes but don't want a big .60? Did you say you want to use the .29 you have on your high wing plane, or have sitting around, because you can't find a good flying ship for it? If your answer is 'yes', then maybe the Graduate is the answer for you.

The Graduate was designed because I wanted a ship that was inexpensive to build, small but not TOO small, could use one of my two Enya .29's, and most of all would be a good Sunday flyer.

I started by looking through my back issues of RCM, and with the formulas I found, I came up with an intermediate size advanced trainer for a .29. After more figuring I saw that the same design with a .35 would become a hot Sunday flyer. How would it work out in the air? I had to find out! With all the calculations completed I now had to make it look like a semi-scale airplane from 20 feet away. I think I suceeded at this but how would it fly? I started construction the day after I finished the drawing. I found it easy to build and not too expensive. So far so good.

The day finally arrived. It was cold and windy but good enough to run the engine with the new carburetor. We went out to the field (Pennsylvania Avenue Radio Control Society of Brooklyn, N.Y.), and fired up the engine. And experienced our first problem - an engine that just wouldn't run properly. So it was back to the work shop to change the engine. How about the new Enya .35, would it fit the same mounting holes? There was one way to find out, and that was to try it. It fits but the shaft is 3/16 inch longer. Back to the field. The Enya started up with a couple of flips. The wind was blowing too hard and it was still cold, so tests were limited to taxiing. In order to find out if it would fly I would have to wait one more week.

Believe me when I say that the week couldn't pass fast enough for me! The big day proved to be not too windy and not too cold. Once at the field, I fired up the engine. With second thoughts I felt that I might not be able to handle this ship. After taxiing around, waiting for my friend to arrive and assist with the first flights, I realized it was getting late and I had to find out if it would fly! The wind was getting a little stronger and I couldn't wait any longer. I gave it high throttle and held my breath. After a thirty foot run it was airborne, climbing and banking to the left. Down and right trim was put in and 'There she goes.' It FLIES!

After a few 360's around the field I knew I had a ship I would enjoy flying. It was a little fast with the .35 in the nose but I still felt comfortable flying it. Well it was up there, and I had to get it down. The wind was much stronger now so I knew I had to make a short approach. Before I could line up with the runway the motor quit and I was committed. Finally, it was down for a three point landing. I was surprised at the control I had

If you want to make the transition from high to low wing aircraft; or if you want an all-around, medium-sized sport model for .29 to .35 engines, then The Graduate is for you.

PHOTOS & TEXT BY JOEL CIMMINO

without power and also at my own good fortune. I had successfully flown my own design without a mishap in spite of my rubber knees!

So that's the Graduate - - - a ship that has good control at all speeds, will take a .29 for intermediate training, a .35 for advanced training, is still on the small side and has very good wind penetration. I think it's good looking too.

Before I go into the construction details, I would like to point out some of the features that you may dislike. First, is the inverted engine. I did this to give the ship clean lines. If you experience difficulty in starting the engine in this position, then put the ship on it's left wing tip and then start the engine. That is why I used plywood wing tip plates. Next is the fiberglass cowl. This also is to provide clean lines. I will go into construction of the cowl and show you how easy it is to make later. The last thing is the use of so much plywood in the fuselage. I felt that the 1/16" ply doubler is as light and as strong as ¼" balsa therefore it allowed me to make a slim fuselage with the added strength of the thick doublers. It also provides a plywood box around the equipment.

Fuselage: Cut out full size sides from 3/32" x 3" x 36" stock. Cut 1/16" ply doublers and glue together with epoxy or Tite-Bond.If you use Tite-Bond clamp the two sides between two pieces of 3/4" plywood and let it stand for about 2 hours, (Tite-Bond is as strong as epoxy when used this way.) Use wax paper between the sides and the 3/4" ply. At the same time you can cut all the bulkheads, F1 through F8, and the 1/8" x 9" x 3" ply servo tray. After the sides have dried, glue in F3, F4, and the servo tray, using Tite-Bond. This will align both sides to each other and also keep both sides square, (that is if you cut the servo tray square!) Next glue in F2 and the motor mounts. Make sure the motor mounts line up with the top of the sides. You will have to pull the sides together a bit. Install the ¼" square longerons and tail post. Pull the tail together making sure to provide room for the hardwood rudder post. After the glue has dried add the remainder of the bulkheads, elevator saddle, and F1. Glue in the bottom block and top stringers. Plank the top of the nose and add the bottom sheeting. The fuselage is now complete except for the hardwood block for the wing hold down. The hold down block is cut to size and then drilled and tapped to ¼-20. Epoxy the block in place. Sand the body to shape and give it two coats of dope. Mix up about 1 ounce of Hobbypoxy II and brush it in the motor compartment and tank compartment and both sides of F2. If you warm the epoxy it will thin out and be easier to work with. Let's stop here and talk about the fiberglass cowl. Most hobbyists shy away from making anything out of fiberglass because they think it's hard to do. It's easier than you think. This is how I do it: Get some styrofoam from a buddy who has just finished a foam wing. A piece about 3" x 4" x 3" will do. Cut it to fit between F1 and F2. Sand the foam to shape on the body conforming to the contour of the nose. Remove the foam and glue 1/8 sheet balsa to the top and back. This will strengthen the square edges which have a tendency to round out. Glue a ¼" dowel in the back as a hold down post. The foam is now given a coat of Tite-Bond and left to dry. When dry, the Tite-Bond will become hard and resist dents and digs. Cover the form with your wife's pastic wrap, and tape it on the top and back. In order to get most of the wrinkles out you must use your little wife's hair dryer too. Heat the plastic wrap until it shrinks. Don't get it too hot or the foam will melt. Cover with **three** layers of Sig light-weight glass cloth. Mix about 1 oz. of Hobby-Poxy II and spread it over the glass. Get the hair dryer again and heat the epoxy. It will thin out and saturate

(continued on page 86)

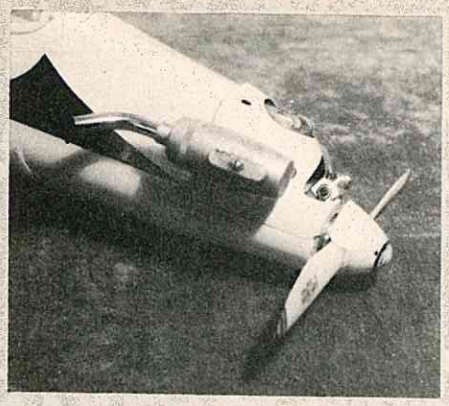
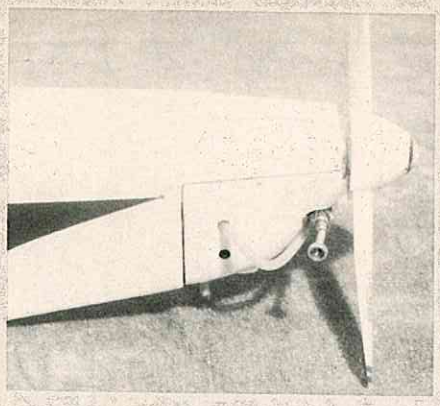
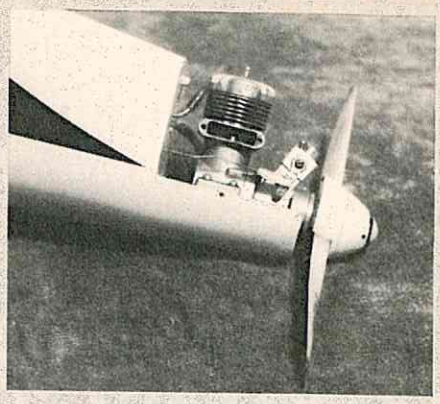


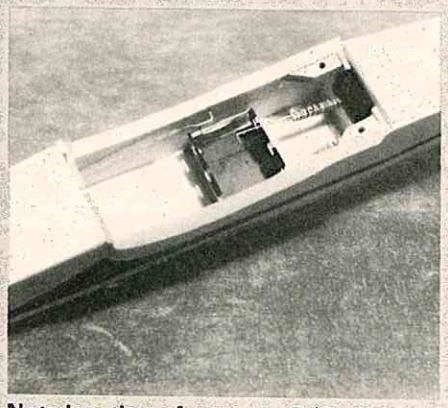
Photo of front end. Note vent behind glow plug.



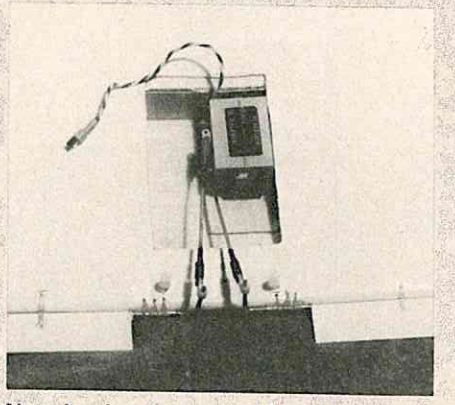
Topside of front end. Note 1/4" gap behind spinner.



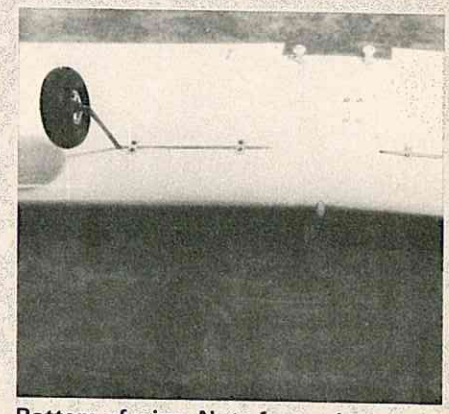
Front end with cowl removed.



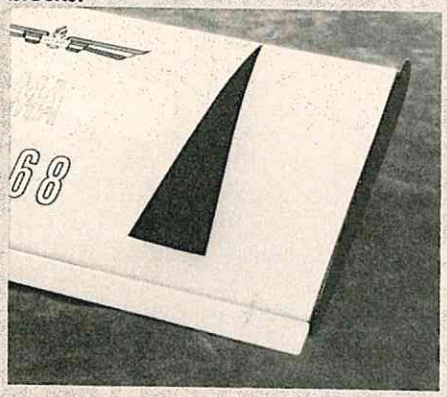
Note location of servos in R/C compartment and tapped hardwood blocks.



Note hookup to control horns and 1/4" x 20 nylon screws.

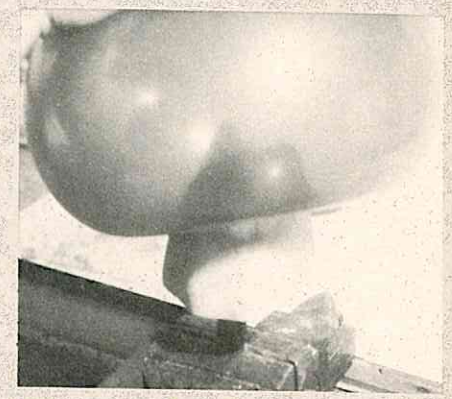


Bottom of wing. Note forward rake of L.G. struts.

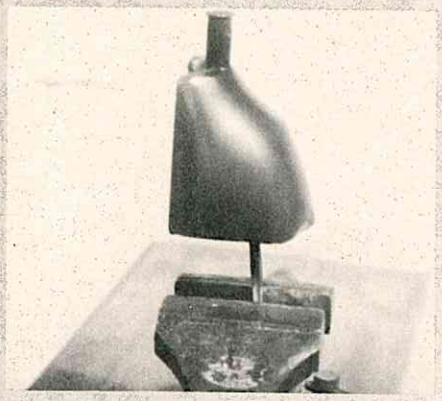


View of 1/16" plywood wingtip plate.

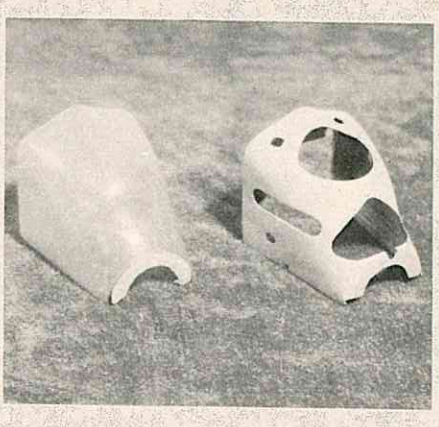
Balsa cowl form wrapped with fiberglass.



Balloon being forced down over form, glass, and epoxy glue.

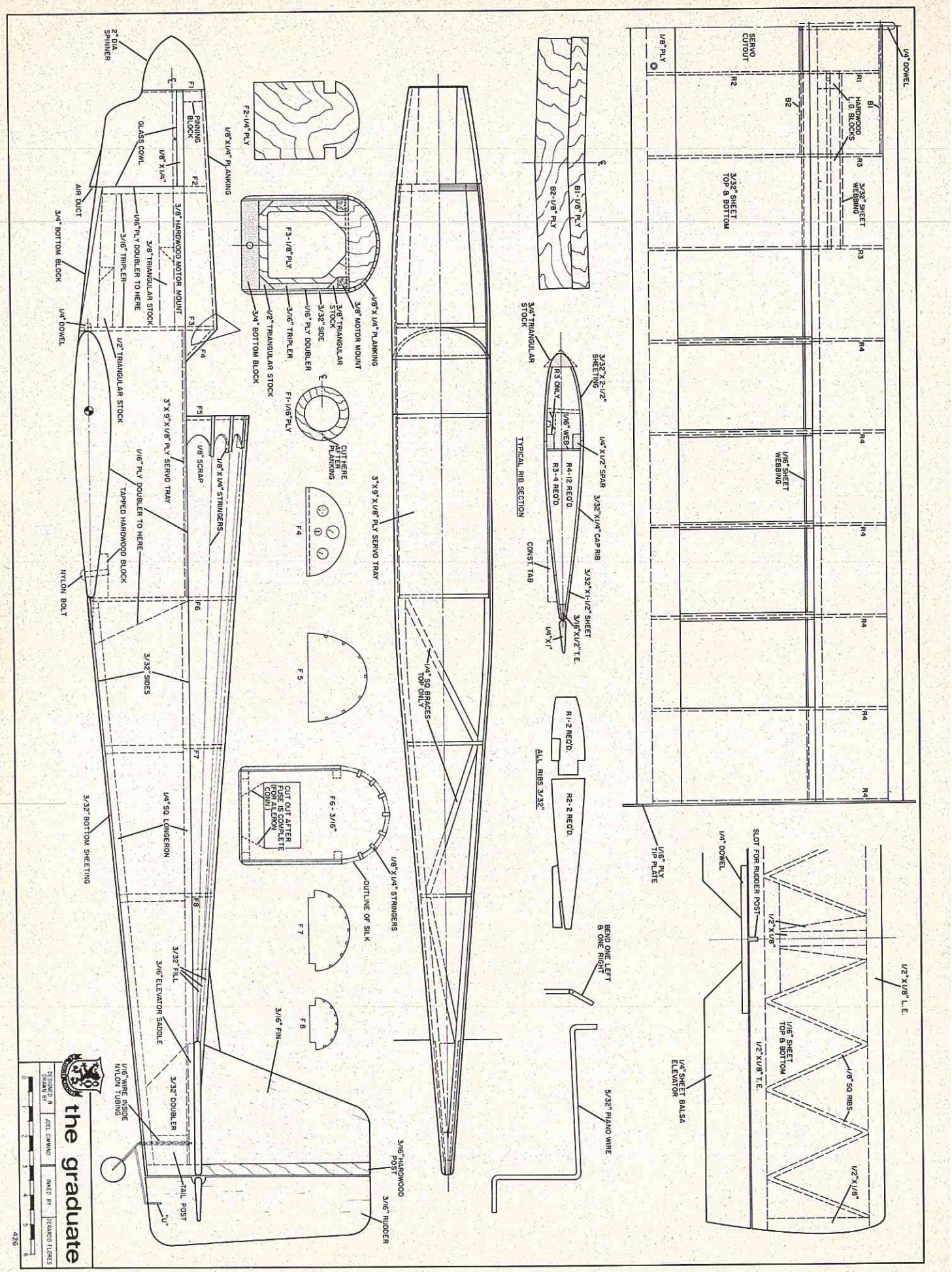


Easy-Does-It balloon in place while glue cures.

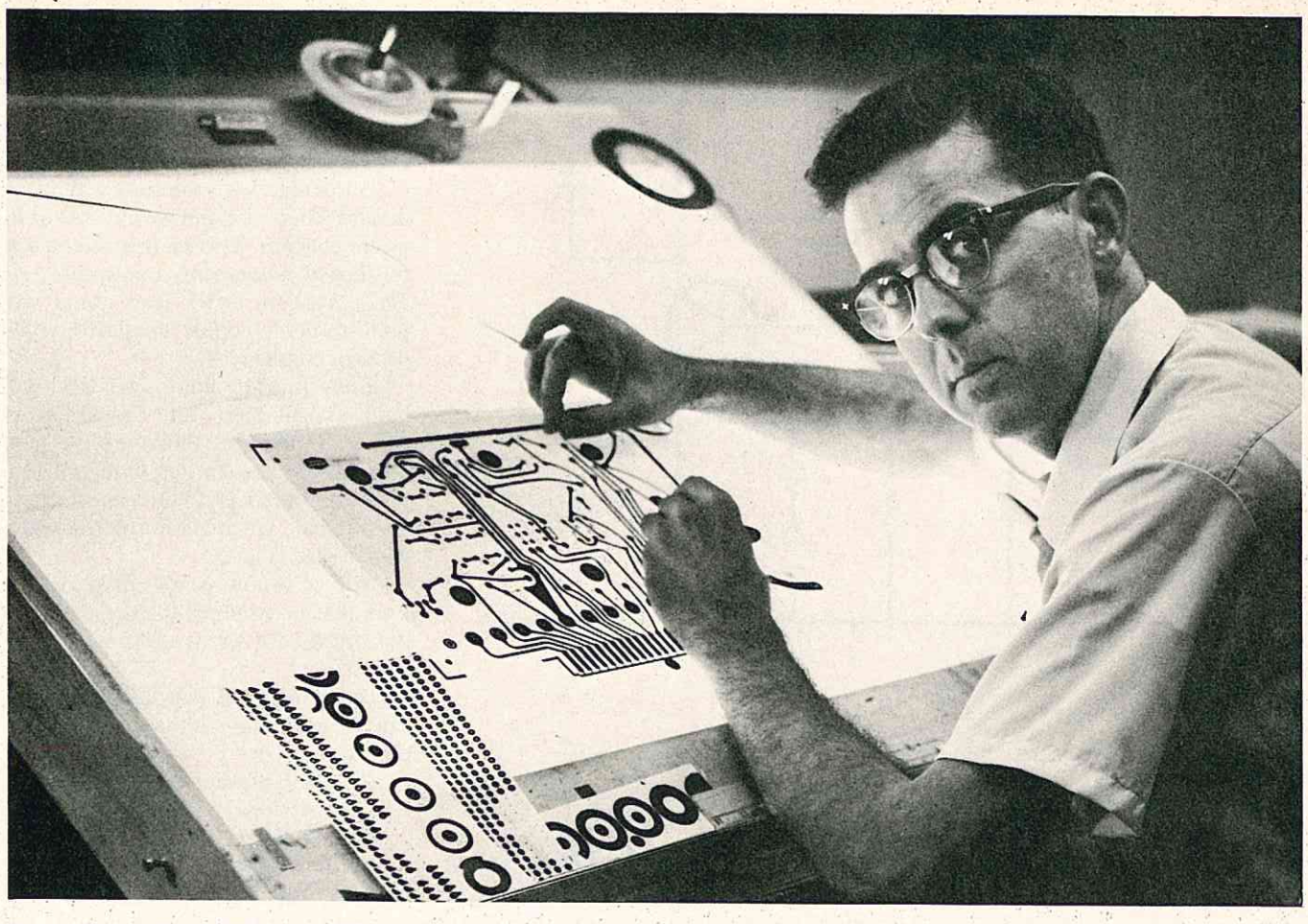


Unfinished fiberglass cowl with finished unit.

Cowl and muffler in place.



FULL SIZE PLANS AVAILABLE – SEE PAGE 71



The author, Bryce Petersen, PC board design Union Carbide Special Instruments Division.

HOW TO DESIGN PC BOARDS

By BRYCE PETERSEN

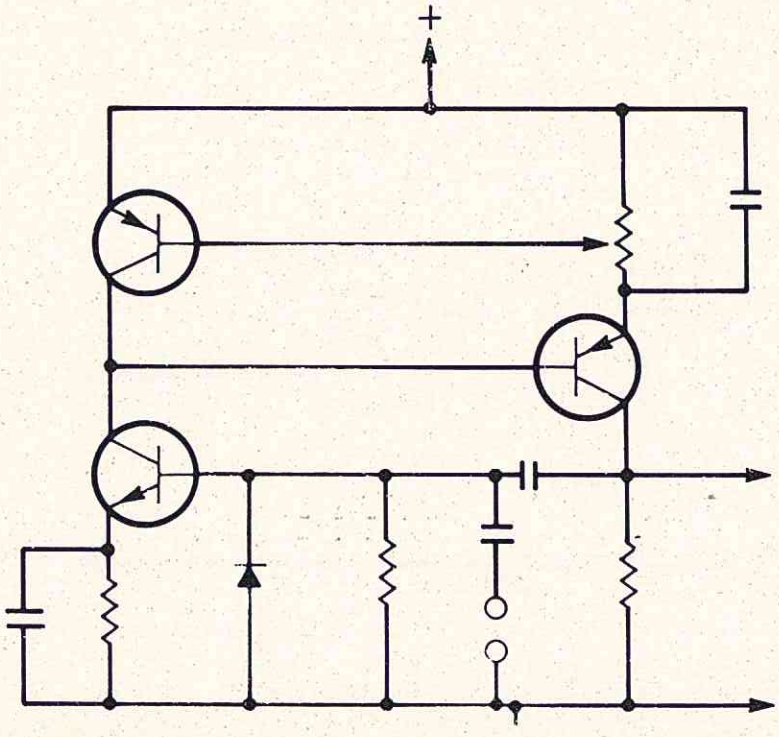
Here is an excellent "How To Do It Article" by one of the country's leading printed circuit designers. It's presentation is part of the ever-expanding program of RCM to present authoratative articles by leaders in their respective fields.

– Ed Thompson, Technical Editor

The fantastic progress being made in the electronics field is so rapid that it staggers the imagination. Daily breakthroughs are becoming so frequent that the design engineers are producing wonderful new equipment that becomes obsolete before it reaches the consumer.

Micro-miniature components are being produced today so small that mounting and interconnecting them is more expensive than the components themselves. The printed circuit board has been accepted as the best way to mount and interconnect miniature components. Most parts today are produced with this

STEP 1 - NICE STRAIGHT BOLD LINES



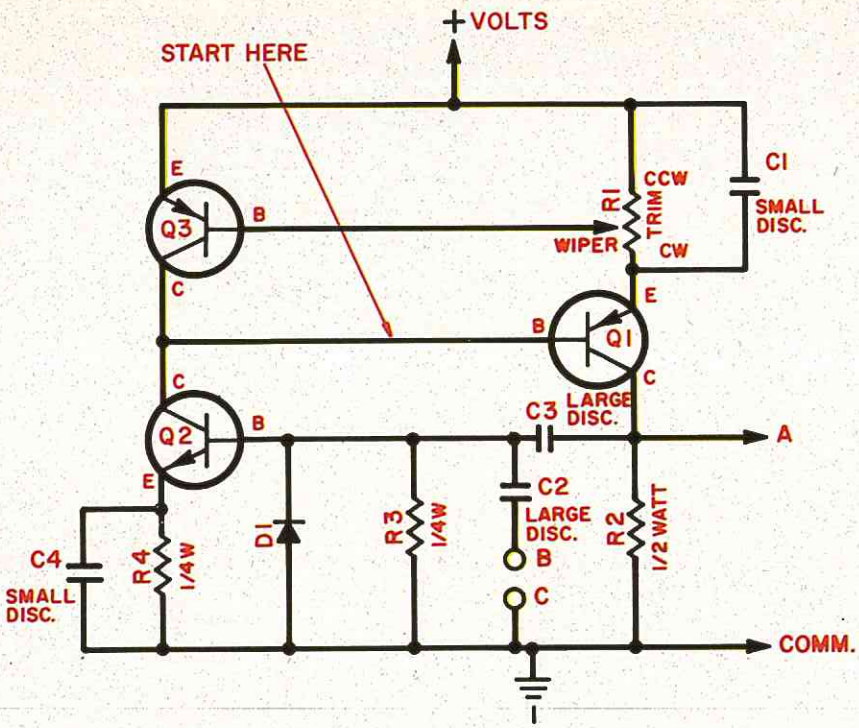


FIG. 2
STEP 2-CIRCUIT READY FOR LAYOUT

in mind and should force the holdouts to follow. Some oldtimers will tell you that hand wiring is superior, and P.C.'s are more subject to failure. This is due to the early days of P.C. development when absorbent materials were used causing warp and stretch from moisture. This caused bad copper bonds and small cracks that were hard to repair. Another major problem associated with P.C. is the use of oversized soldering equipment (too hot) and a general lack of knowledge about soldering.

Transferring the schematic to a clean, well designed P.C. board will add professional appearance and performance to most circuits. This article is designed to help the average Joe in his home workshop to produce highest quality designs at minimum cost. Some of the ideas described here are unique and offer a shortcut towards obtaining final results. I will not dabble into rigid specifications that can be found in engineering manuals, but, instead, try to show a way that these specs are adhered to.

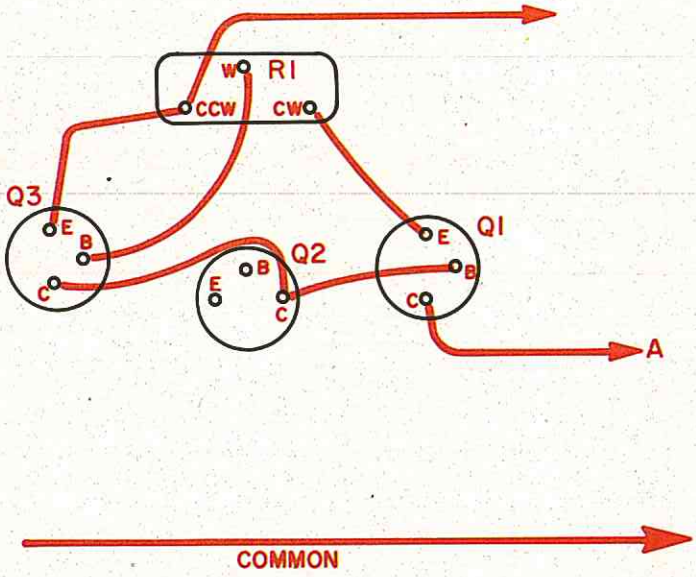


FIG. 3
STEP 3- LAYOUT YELLOW LINES

The First thing to keep in mind is that your final result depends on the **quality of your art work**. This is the key to beautiful boards.

Let us start with the average type P.C. designs where size and weight are not the prime concern. This system can be used for bench equipment, transmitter, etc. This system will leave you with point-to-point copper lines with solder pads for components.

First, prepare your schematic with bold straight lines (Fig. 1). Add everything you can think of to your schematic – like emitter, base, collector, resistor-in-watts, etc. Your concentration must remain on circuit routing instead of what's what (Fig. 2).

With a yellow pencil, draw over all lines that go from point-to-point and do not break with a resistor, capacitor, etc. (Fig. 2).

These lines are roughed in first because they cannot jumper with a component (Fig. 3).

Start with power lands and then transistor connections.

The next step is a rough pencil layout to transfer from schematic to P.C. layout in rough form. We are not concerned with spacing or physical dimensions so leave extra space between components for other parts to fit later. As each line on the schematic is roughed in, trace over it with red pencil to check your progress (Fig. 5.)

After a few trial-and-error steps you will begin to memorize the circuit and should be able to think ahead of your progress three or more components.

Always layout on the **copper side**. This will mean you are looking at the bottom of your components. Most parts come with the pin key and measurements on the bottom side.

Board terminations and power lands always go on first. If it is a plug-in type design, all terminations will have to come off on the bottom.

Another consideration is the symmetry or balance of your design. It is usually possible to keep your components in line with each other in groups, either vertical or horizontal. This is accomplished after the rough is completed and you begin to memorize the circuit. The only time this is not desirable is when crosstalk demands isolation in certain areas, but even this type design can be balanced for good appearance. Do not be afraid to give up and start over when you find it will not work out. Remember, there is a way it will work and usually without jumpers. Usually, a different approach will open different

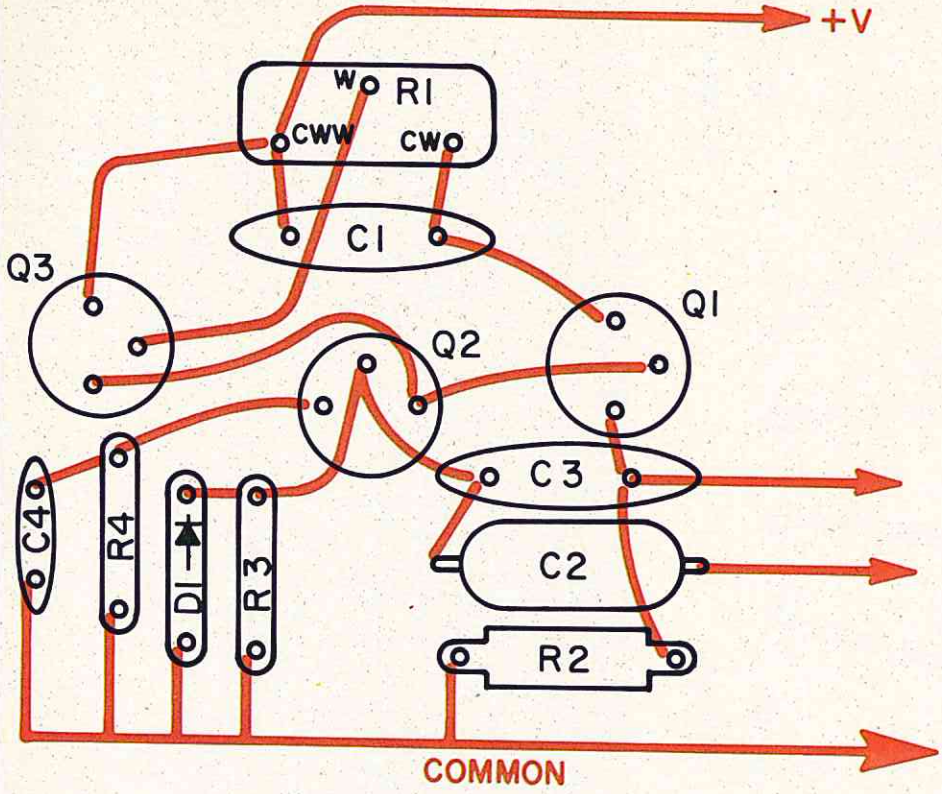
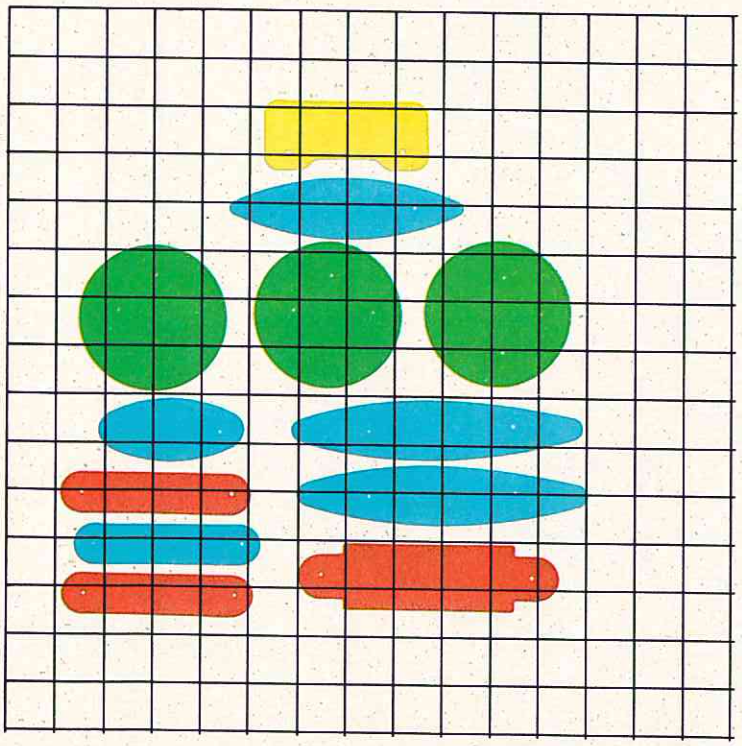


FIG. 4
STEP 4 - FINISH ROUGH LAYOUT WITH ALL COMPONENTS

STEP 5 – DIFFERENT COLOR CUTOUTS PLACED ON GRID PATTERN FOR EXACT SPACING FOR TAPE



avenues that do not exist other ways. Also, make up your mind from the start that a **jumper** (a piece of wire to jump over existing copper) is a dirty word. Try to space component leads the **same distance apart**. Resistors, for example, can be **jig bent** in advance and will speed construction time.

After the rough is finished, you have a **plan** for your final layout and you can proceed with your final art work.

A 1/10 in. grid (found in drafting stores) is placed over a light table (Fig. 5) and X2 cutouts of all parts are positioned on the grid for accuracy (Fig. 6).

A clear sheet of cellulose or mylar or onionskin paper is secured over your patterns to receive the final art work.

Figure 7 illustrates a good selection of drafting aids (tape) that will satisfy about all types of P.C. layout and can be purchased from

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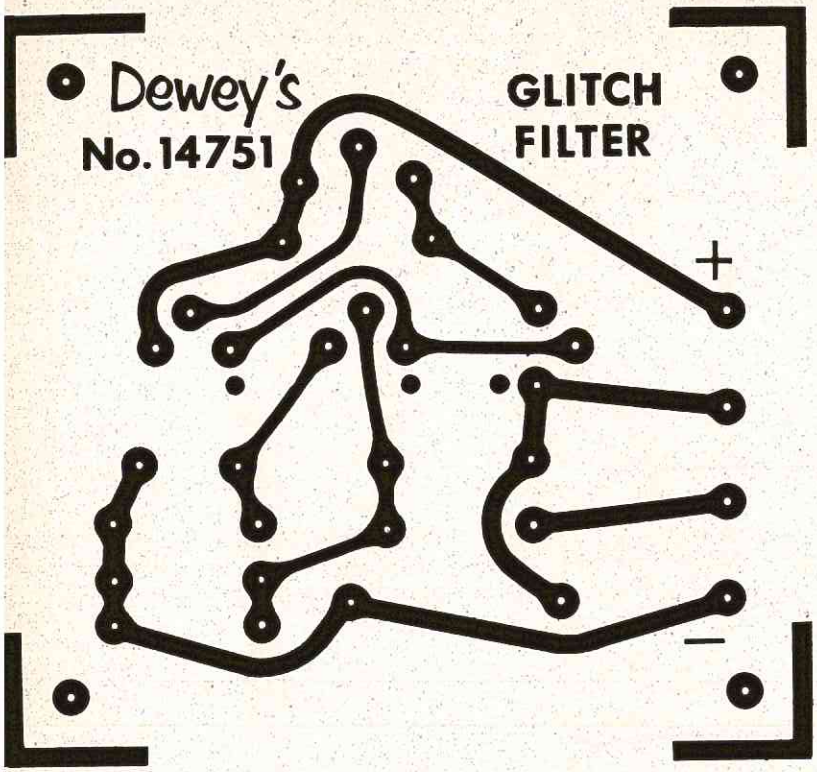
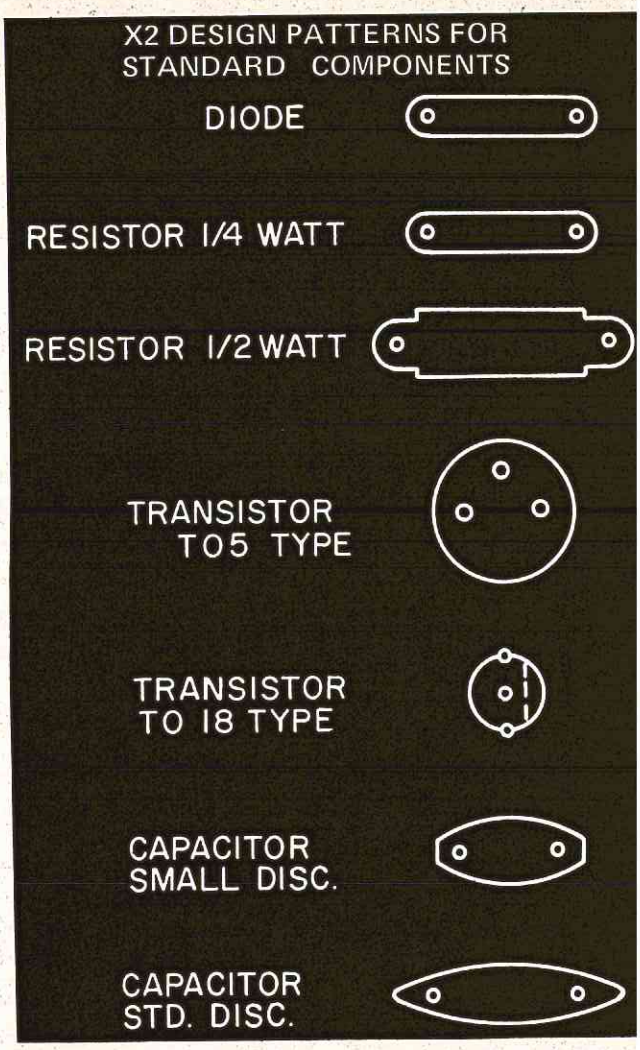
Figure 8 will illustrate how to make a bend with universal corners and how fillets and tees are made with the circles.

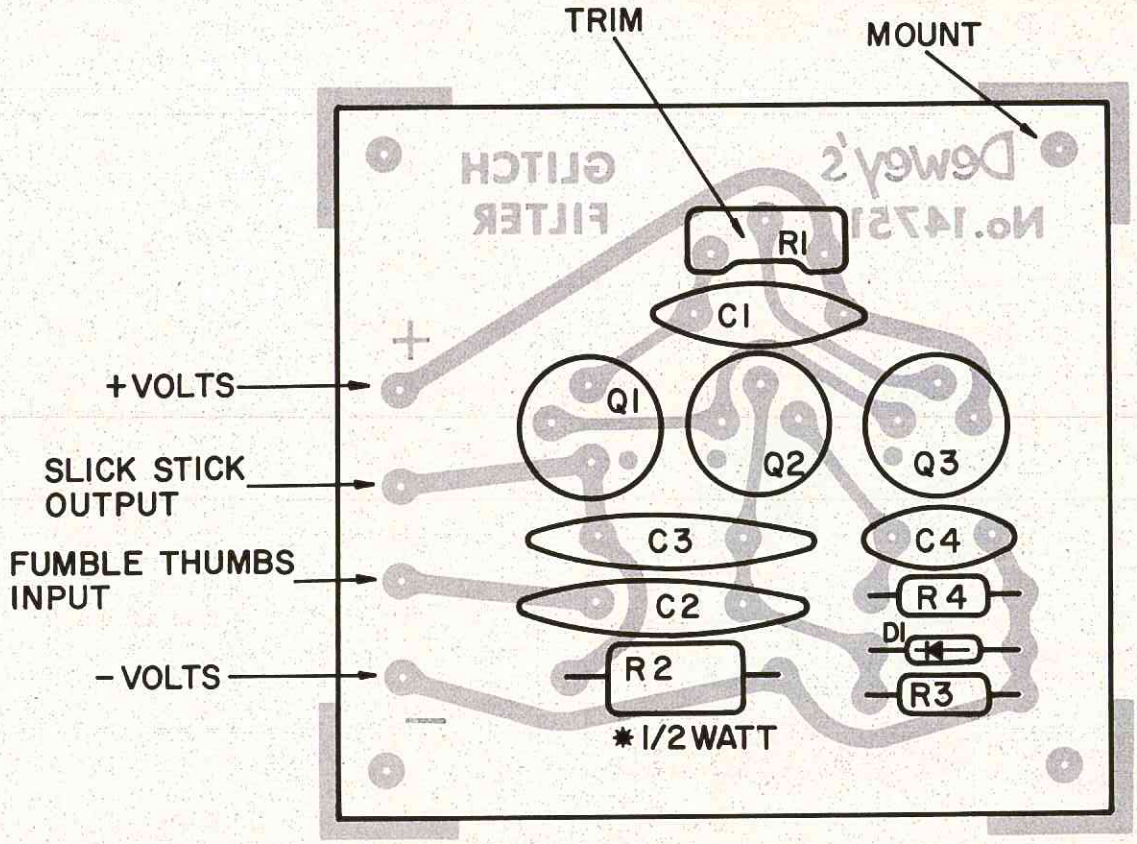
Figure 9 illustrates why the corners are preferred over bending the tape. Although bending tape is practiced by many professionals, it is **not** good practice.

Figure 10. A quick look should help you decide how to go from point to point with your tape and pads. Again, I will remind you that a little extra time and patience to produce straight clean lines will be rewarding. Another rule to follow when using P.C. drafting aids is to use them **as is**, and **do not** cut or alter them in any way for extra room. Take another look at your spacing if things are too close.

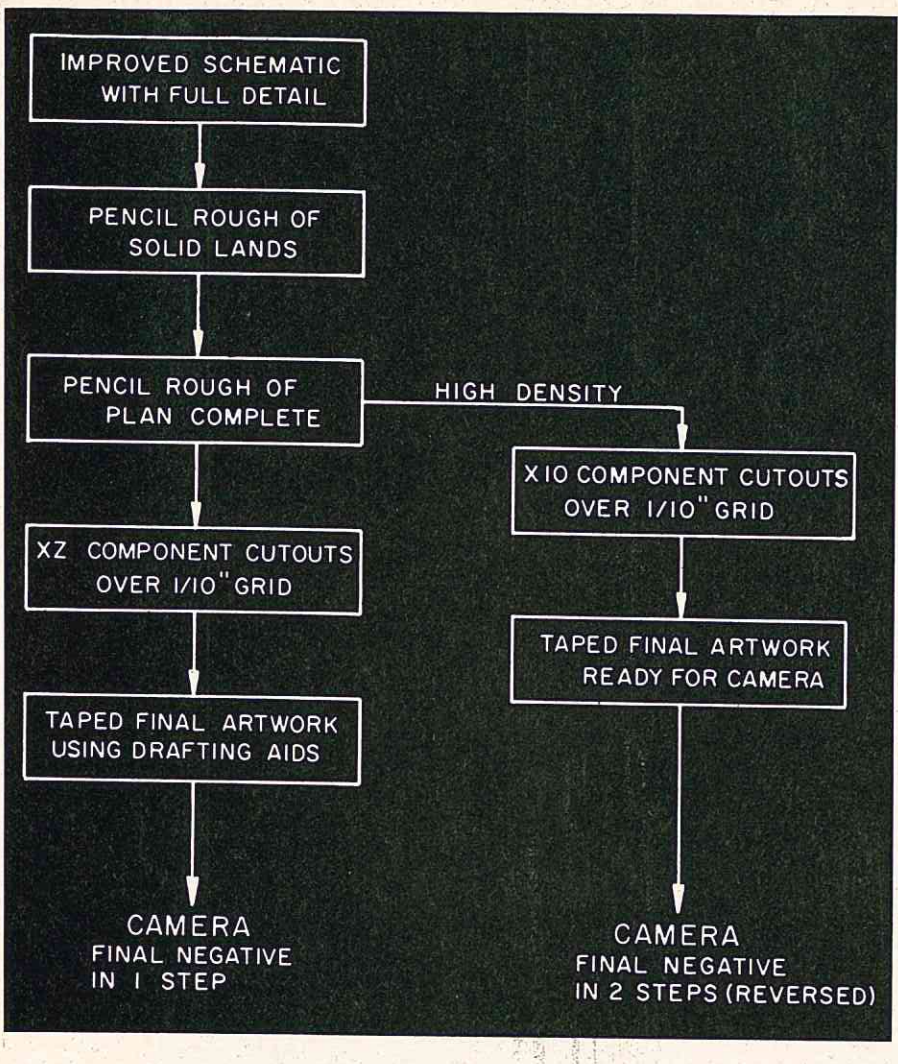
So far, we have discussed how to design P.C. boards for standard type circuits where size and weight make a little difference. From this point we will discuss micro circuits for highest possible density, like the type used in R/C airborne equipment. Since the parts themselves become the size dictator, careful attention should be given to the smallest possible parts available. Thanks to the space program, micro-miniature resistors and capacitors are available, but at a premium price. The copper that is left on the board should be considered **after** the parts themselves are squeezed together as close as possible. An X10 pattern of each component is positioned on the grid (Fig. 11) so the leads will fall at a place they can be tied together with **islands** of copper. Drafting aids (pads) are almost useless for maximum density designs because a cluster of miniature components







COMPONENT SIDE
2:1

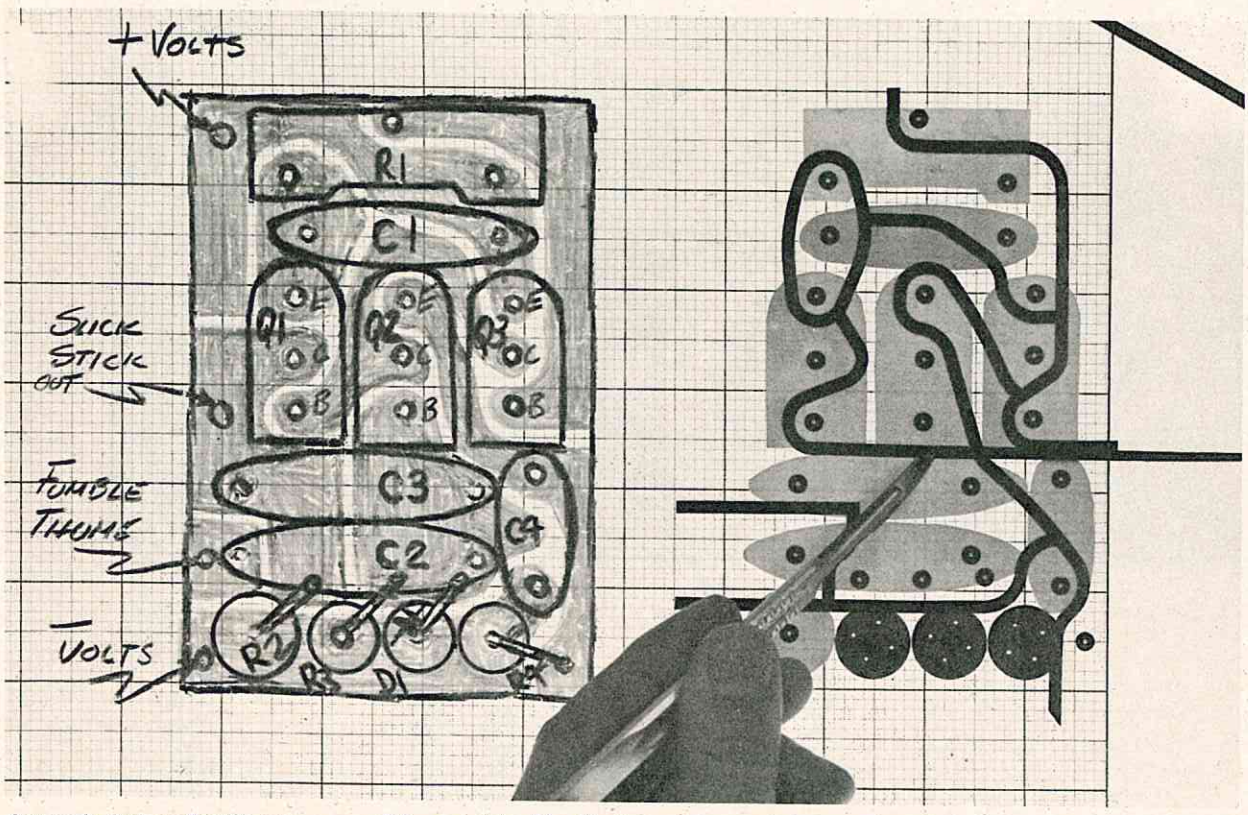


will not leave enough space underneath to accomodate the pads. Instead, a different technique is used to create **islands of copper** instead of lines of copper with solder pads.

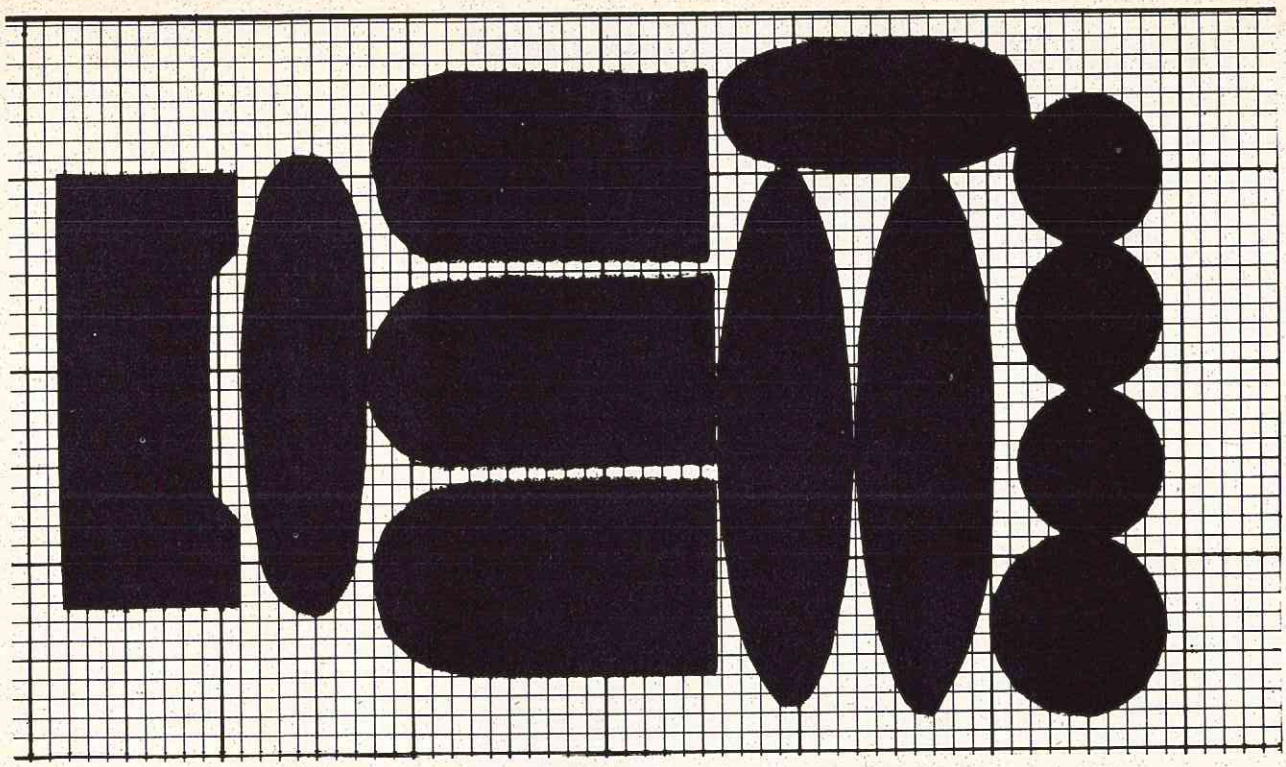
The designer must think in reverse and use his black tape for insulation lines instead of copper lines. In other words, the tape represents where the copper is **etched away** instead of where it is left. One problem is to leave enough copper to accept the drilled holes and not bridge the copper next to it. It is also necessary to leave enough copper surrounding the holes to accept solder. A game of give and take between components with constant shifting of parts must take place. After you have what looks like the best possible arrangement, the chances are that changes **could** save you as much as 20% and still leave you enough copper to drill and solder. Sometimes a space saving change can be right in front of you and you can't see it. I suggest you take a break overnight and take a fresh look the next day before you finalize the design. Remember, when it is in copper it can't be changed without goofing up the looks.

(Fig. 12). Four resistors stood on end. Careful placement can save space and the resistors themselves become insulating spacers.

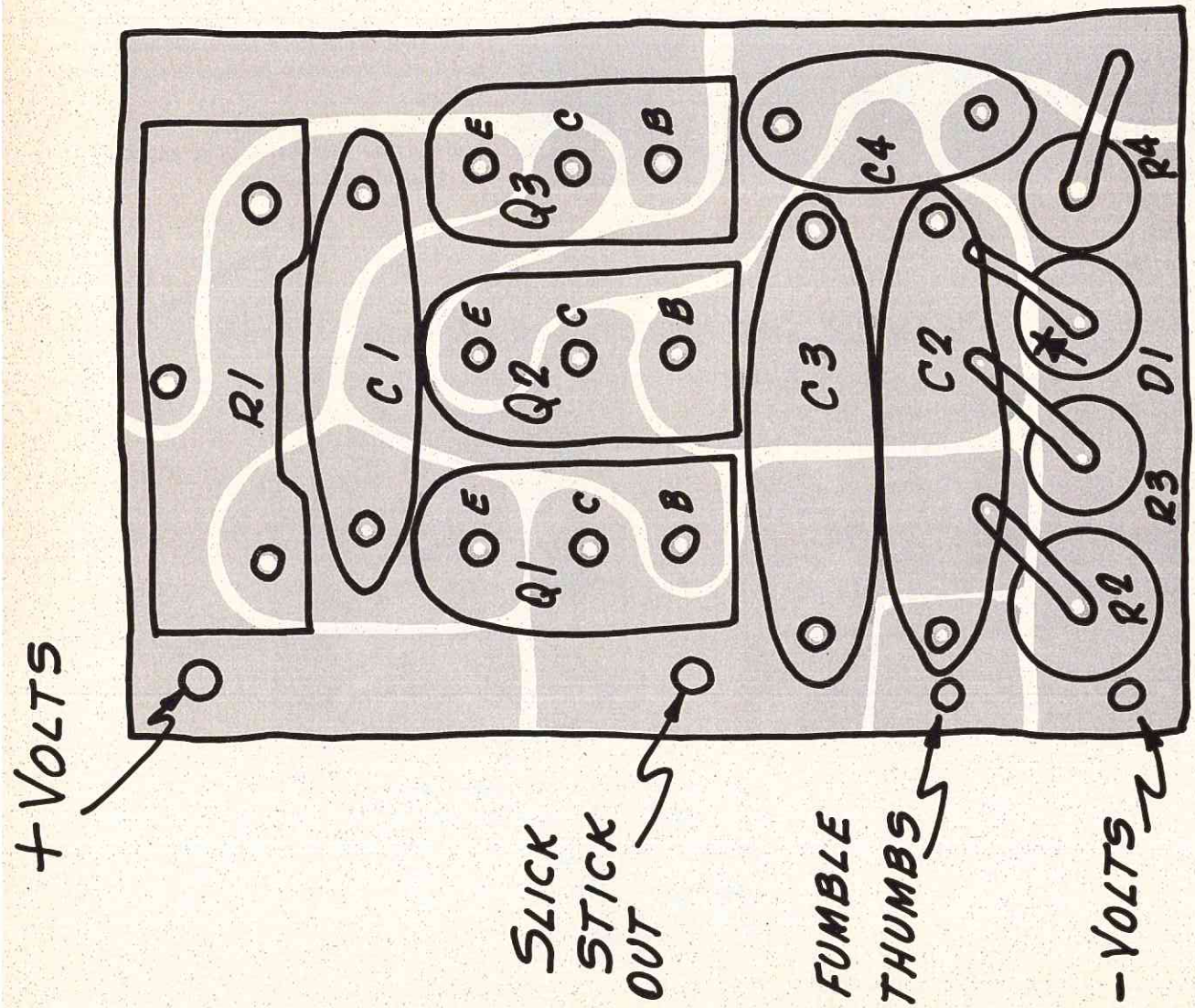
(Fig. 13). Never solder component leads in this manner. Always terminate component leads to copper. ●



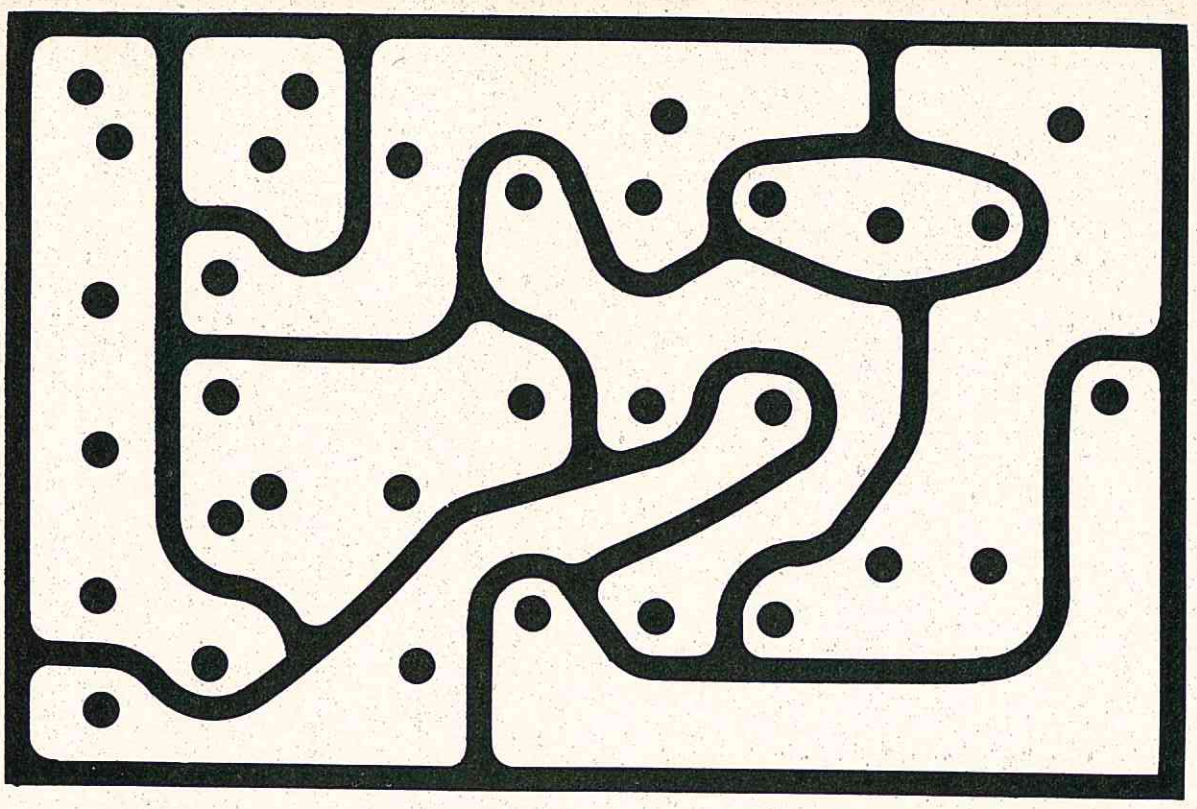
Artwork designed with grease pencil for a guide. The final taped artwork is completed.



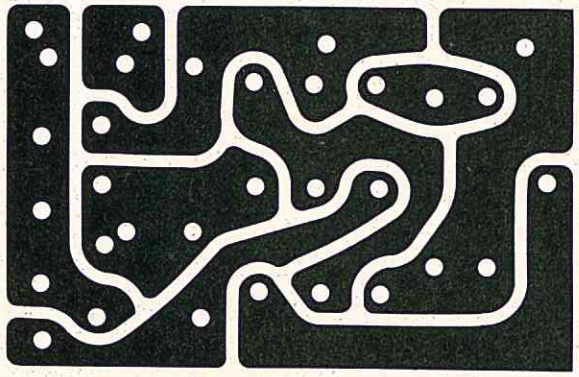
X10 COMPONENT PATTERNS PLACED ON GRID AND READY FOR ARTWORK



WHEN DESIGNING MICRO CIRCUITS, A GREASE PENCIL CAN HELP CREATE ISLANDS OF COPPER, TO HELP PROOF PART'S PLACEMENT

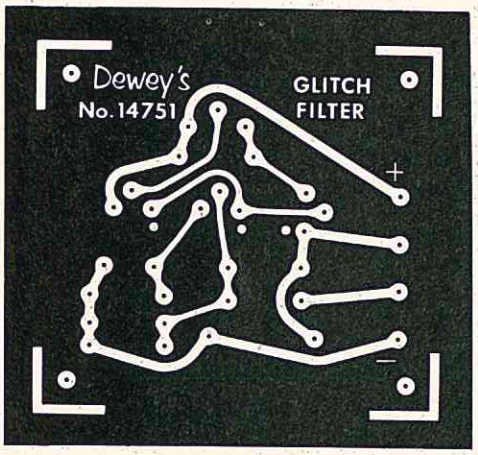


ABOVE: X10 MASTER ARTWORK READY FOR CAMERA. LEFT: INTERMEDIATE NEGATIVE READY FOR CAMERA

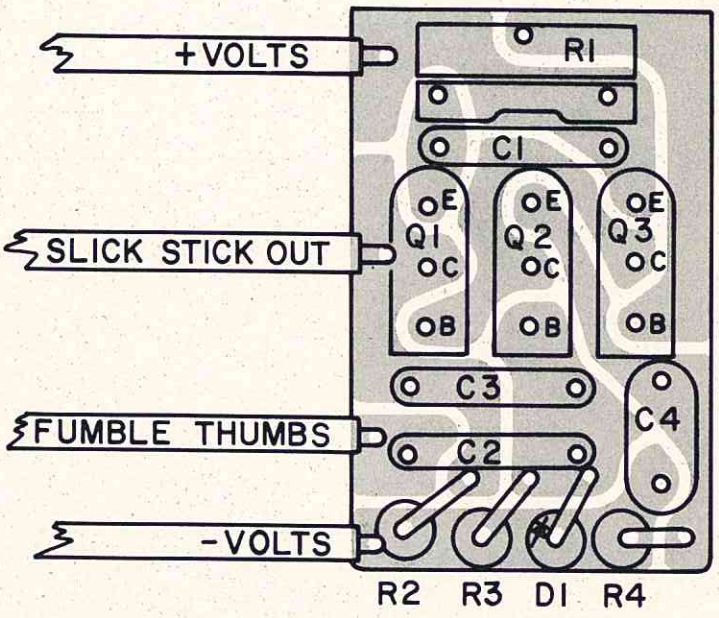


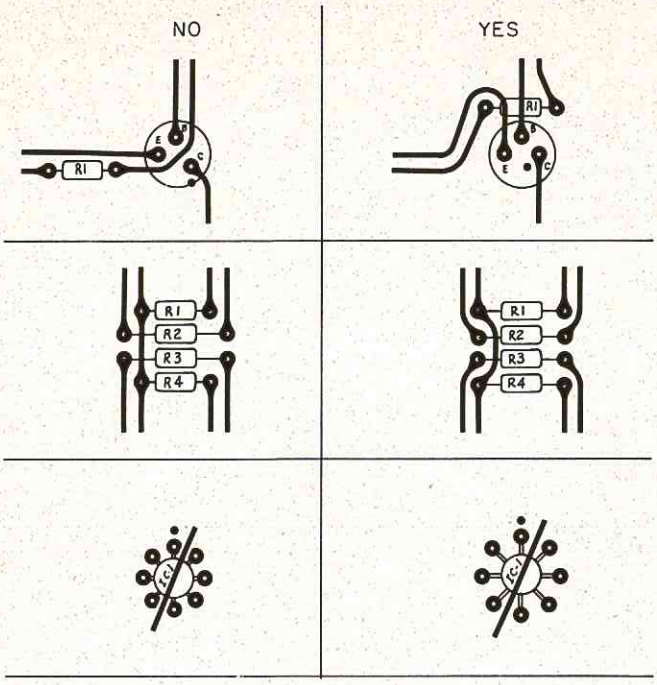
X5 PLANS FOR MICRO CIRCUIT

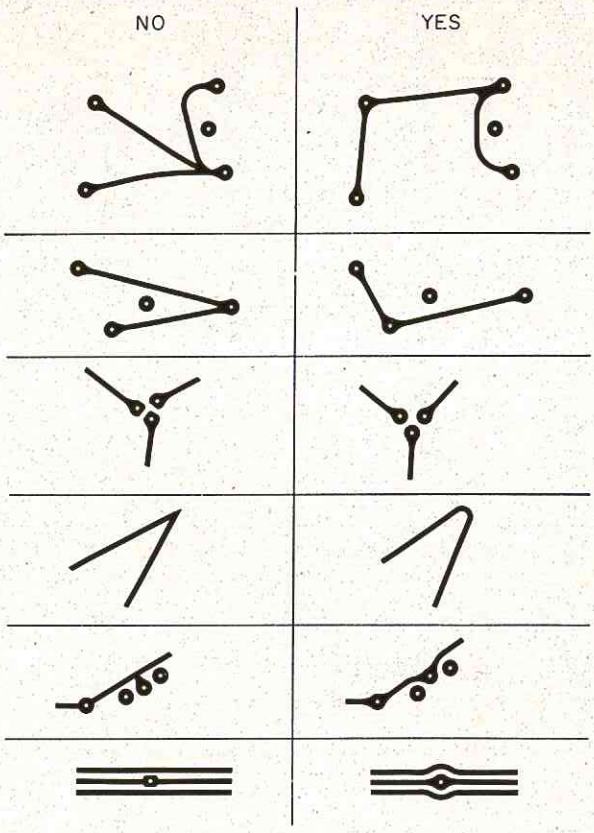
COPPER SIDE 5:1



NORMAL AND MICRO DESIGNED P.C. MASTER NEGATIVES OF THE SAME CIRCUIT, READY FOR ETCHING







DO'S AND DONT'S OF TAPE LAYOUT

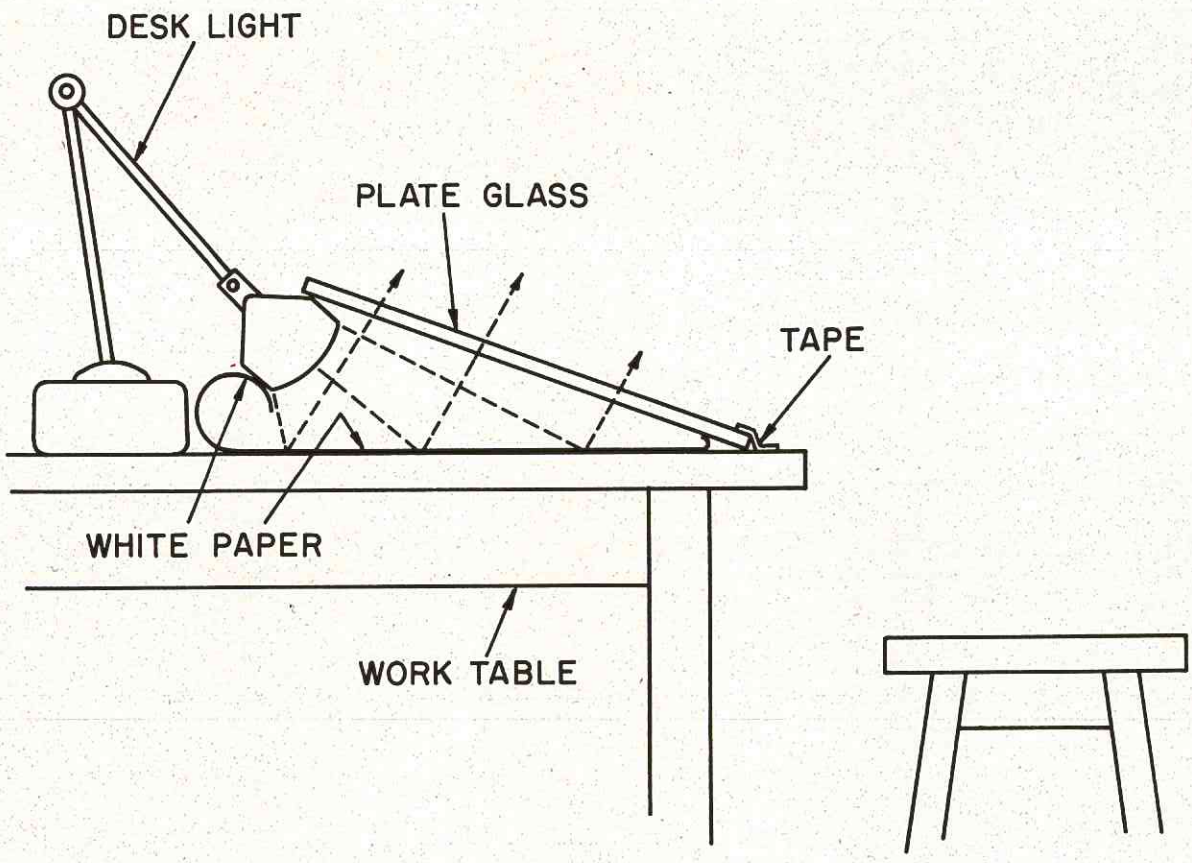


FIG. 5

TEMPORARY LIGHT TABLE FOR PC DESIGN WHEN SEE THRU GRID IS USED

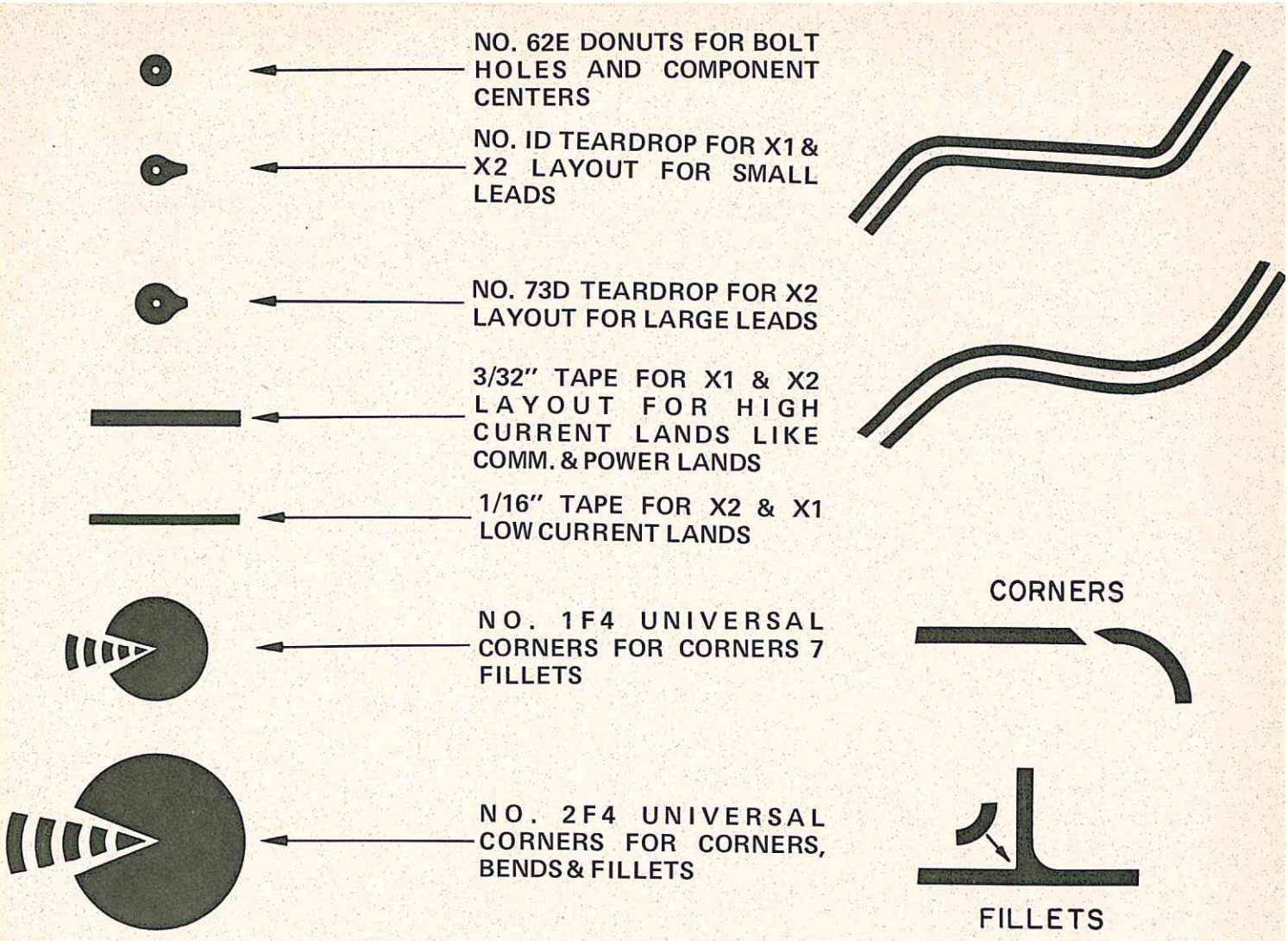
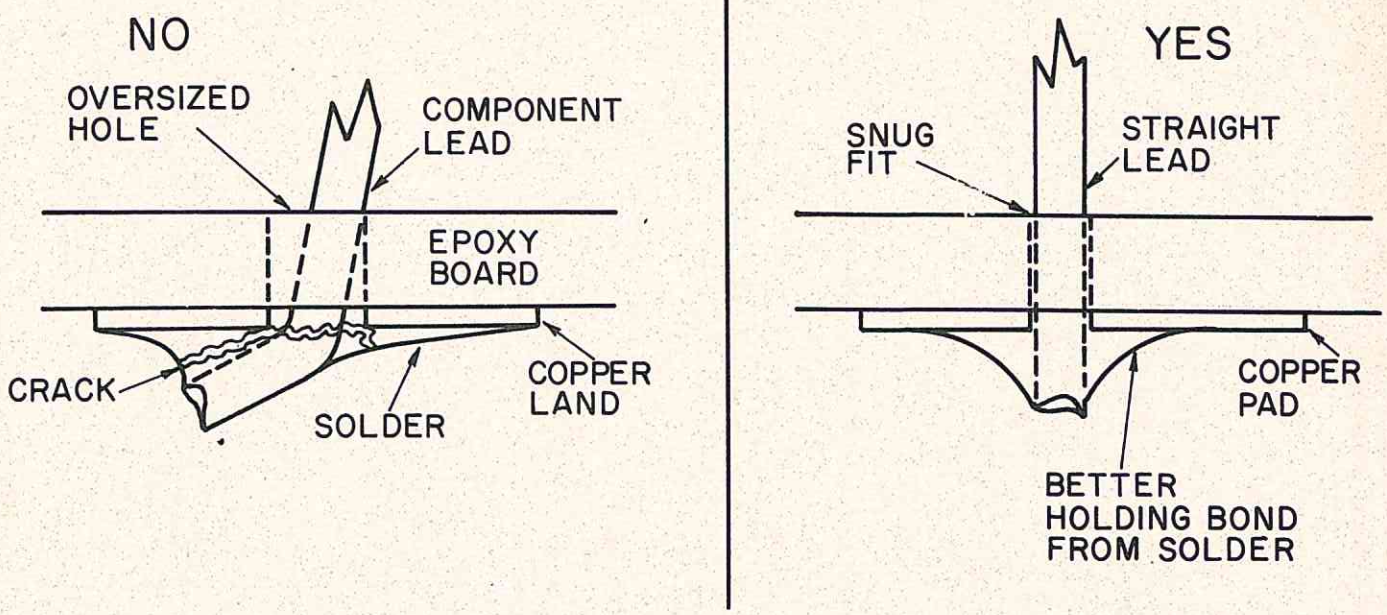
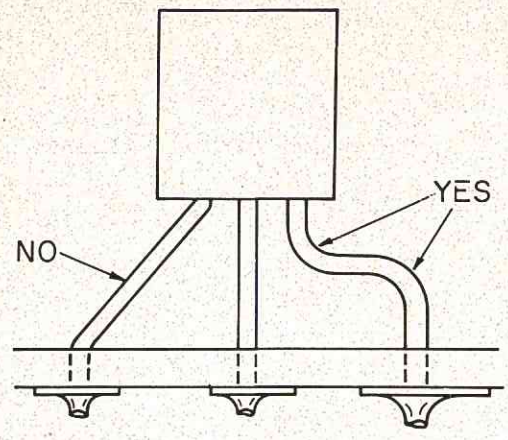
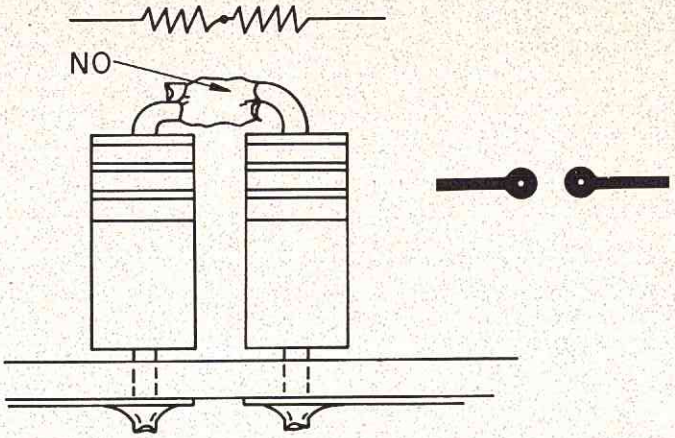


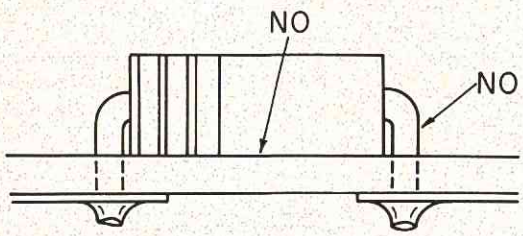
FIG. 7: SUGGESTED TAPE DRAFTING AIDS

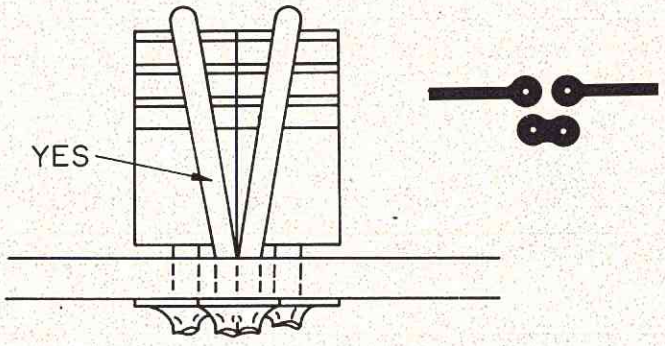


DO'S AND DONT'S OF PC BOARD CONSTRUCTION


NO
YES


NO


NO
NO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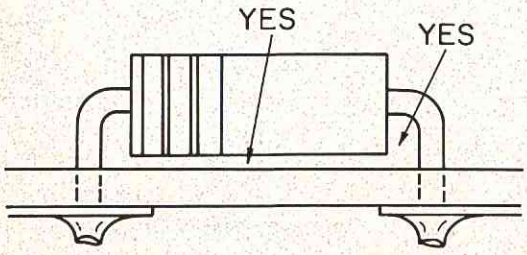
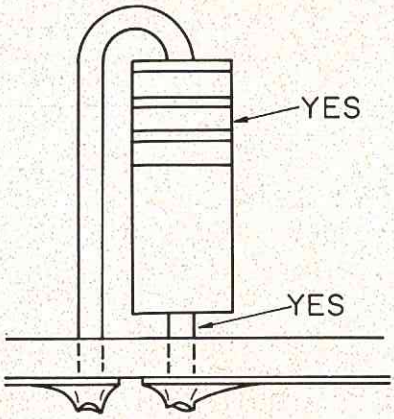

YES
YES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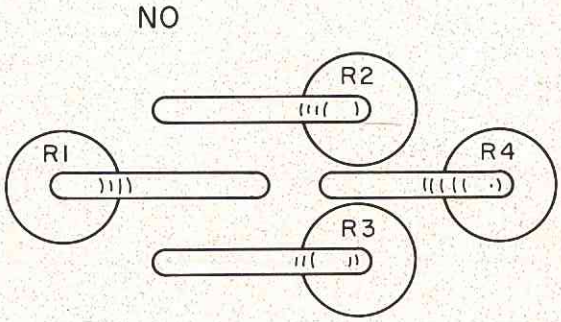
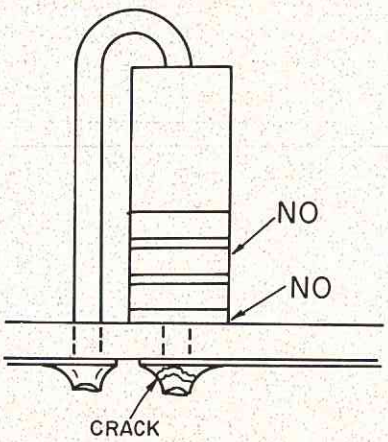
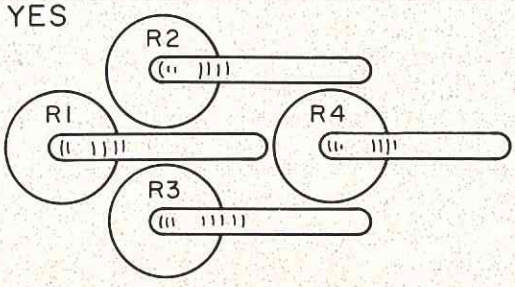
YES


NO
R2
R1
R4
R3


NO
NO
CRACK

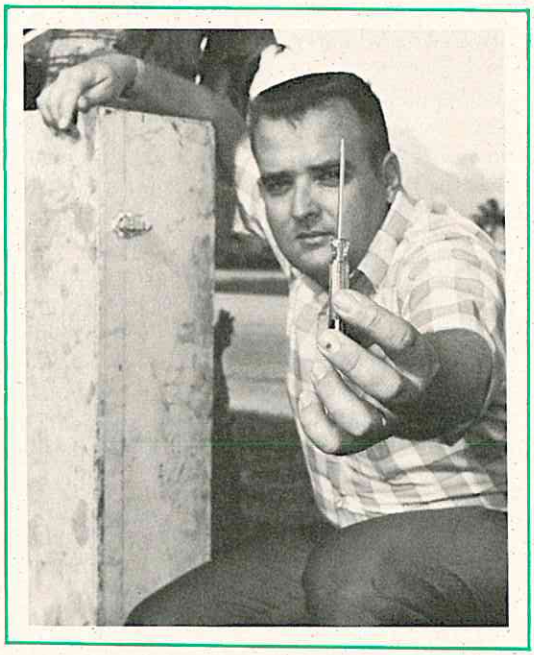

YES
R2
R1
R4
R3

IF IT
HAS TWO WINGS
AND FLIES
THE PATTERN
INSIDE A C-141
IT'S THE

CHIGGER

By
JIM SIMPSON

A chigger is a small red bug, common to the sunny South, which gets under your skin! I'm naming this airplane 'Chigger' because I'm so very happy to be back in the sunny South and because I hope this design appeals to you – that is, gets under your skin.



The original idea for a bipe this size came to me one afternoon as I drove from Rapid City, South Dakota, to Lead, South Dakota, to see a good friend of mine, one Doctor J.J. Smith. The outside temperature was sub-zero (not unusual, despite local Chamber of Commerce propaganda to the contrary) so we had a lot of time to daydream! I mentioned to Dr. Smith how I thought the Jr. Falcon would make a good biplane. I'm not sure he agreed but he gave me a Jr. Falcon Kit, sans fuselage and plans. I took this box of parts home where it collected dust until I gained favor withthe powers to be and was transferred to Carswell Air Force Base, in Fort Worth, Texas.

Well sir, shortly after I arrived in Texas I began to thaw sufficiently to regain my interest in R/C. While I built a "Little Toot" Biplane by Son Syl products from Houston, Texas, I began to dream up this biplane shape. Next I got out an old issue of "Sport Aviation" and looked at biplane pictures and, Bingo, here comes the Chigger!

I traced a Jr. Falcon rib on a piece of 1/16 plywood and cut it out on my Dremel jigsaw. Then I built the wing panels from the kit parts, went to Ed Alexander's Hobby House (one of the all time best hobby shops in the U.S.), bought shaped leading and trailing edge stock and went back home to do the top wing.

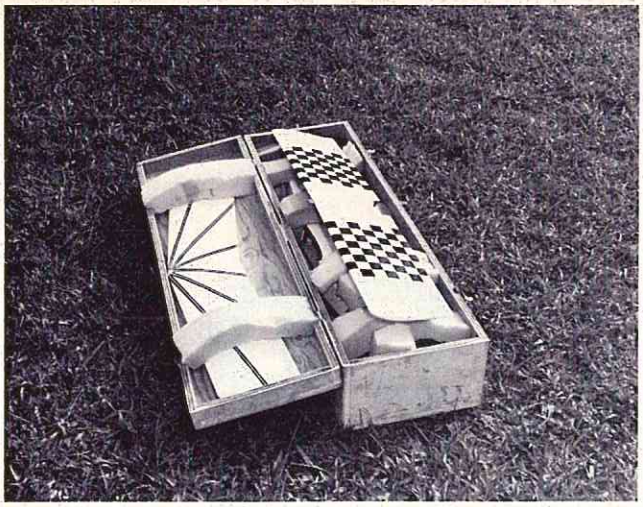
Right here I would like to compliment Mr. Carl Goldberg for the really great basic design involved. I'm sure he could really tell quite a story of how he came to find that what's here provides sufficient strength with light weight. I can tell you that, so far, the kit wings have held up just fine on my model so you might consider getting a Jr. Falcon Kit.

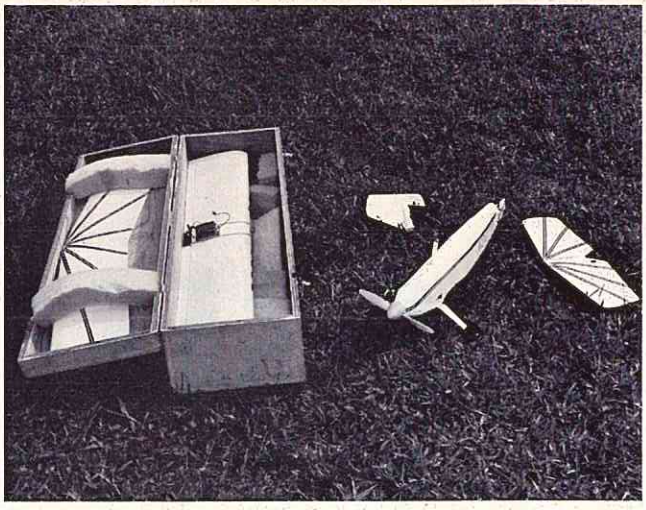
I used the "store bought" leading and trailing edge stock to build the top wing. Just lay out the trailing edge stock with 7½° sweep in each panel and notch it for the ribs with the same spacing as the bottom wing. Then pin it down flat (glue center section, too), glue in the ribs, add the leading edge (glue the center section too), slide the spars in from the tips (glue the center section too), add tips, and you're done with the top wing! When it's dry you can add the doublers for the struts and sand it for MonoKote, which is made by Top Flite Models in Chicago, Illinois.

Right here I want you to notice how I drop names and addresses. I do it because I assume folks read this trivia and maybe the named manufacturers will see fit to donate some their products for me to experiment with and comment favorably on! Payola, huh? Well so far this plan has had an absolute negative result. You might remember in June, 1969 RCM I mentioned a certain device which was good to build wings in, or on, or with, or something, and I really hinted how I'd like to have one? Well, I still don't have one and I know folks talk about it because people asked me if I ever got one! So now I want you to notice how I neglected to mention this device or contraption whatever it is! Also, notice once again how I mention so many fine folks, here.

OK, back to work. Join the bottom wing panels with ½" dihedral under each tip (or 1" under one tip with opposite panel flat, Dewey) and plank the center section. If you used the kit parts you must now trim off the trailing edge to accept the full-span ailerons. You can use Top Flite aileron horns if you'd rather not bend your own.

If you are familiar with any of my previous design you will note right off that there are a bunch more parts in this plane than any previous one. I hope you won't let this bother you too terribly much because a biplane is really no more





complicated than a four wheeled bicycle!

So on with the tail, already. First cut the rudder and fin from ¼" sheet balsa. Notice that the fin has two keys which fit a slot in the horizontal stab. Now round off the leading edge, taper the trailing edge, sand it smooth then build the elevator assembly.

On the original "Chigger" I used the Jr. Falcon kit parts but as I had no plans I just "wagged" it and am told this horizontal stab is larger than the original kit required. I don't think it would make a tremendous difference if you used the standard Jr. Falcon stab; just remember to leave a ¼" slot in the top center section planking into which the fin will fit. This horizontal stab is built in your hand, if you will. That is you slide the ribs in place on the spar then pin the leading and trailing edges in place. While the glue is wet, check the alignment then pin the tips in place and when dry sand it all to shape. This leaves us the fuselage!

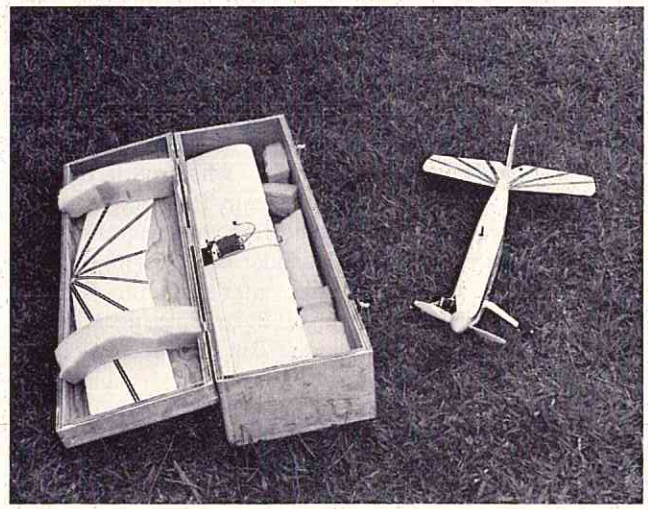
Cut the sides from 1/8" x 3" x 36" balsa. This standard size is available everywhere and is not especially higher priced. I just have to advertise this fact in protest of the "matched fuselage sides" you think some people have to make special.

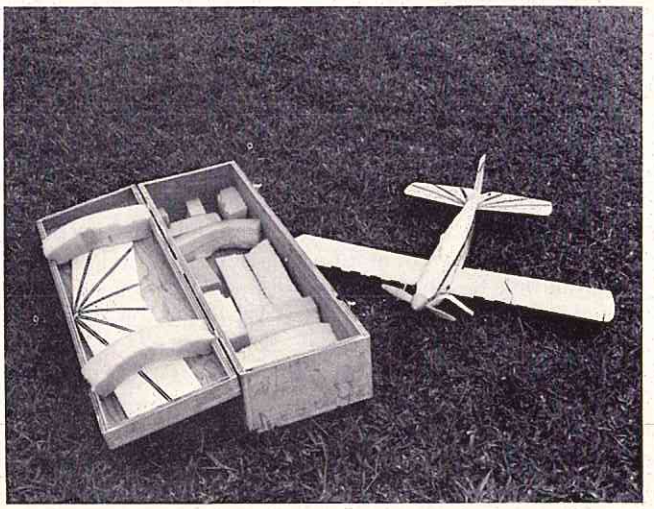
Cut all the formers on your, or someone's, Dremel Jigsaw (oh boy are these ever nice little machines, which no modeler should be without.) Then add 1/8" scrap balsa stock cross-pieces at the top and bottom. Now draw a ball point pen center line on each former and stick a pin in the top edge of each former aligned with the center line! We will use these pins to insure that the fuselage is straight after we glue all the formers in place and tape the whole ball of wax together! We do this by sighting from the front, or rear, of the fuselage and the line of pins should appear as one. If they're out of line use strips of tape to pull the fuselage sides in line. On the original "Chigger" the top of the fuselage aft of the lower wing was made with stringers. I considered it inefficient and recommend you use sheet balsa.

The easiest way I know is to wet one side only of some soft 1/8" or 3/32" sheet balsa cut slightly oversize and slowly bend it to the required radius then trim it to fit and glue it on. Be careful not to pull fuselage out of line. Once the fuselage has dried you may mount your engine on the firewall, then build up the cowling as shown on the plans with scrap balsa. And for Pete's sake don't forget the plywood ring right on the front. It adds tremendous strength.

What we have at this point is a fuselage shell with the bottom entirely open. You better not have put it on yet! If you did you deserve your misery for not reading the directions, so cut it all off.

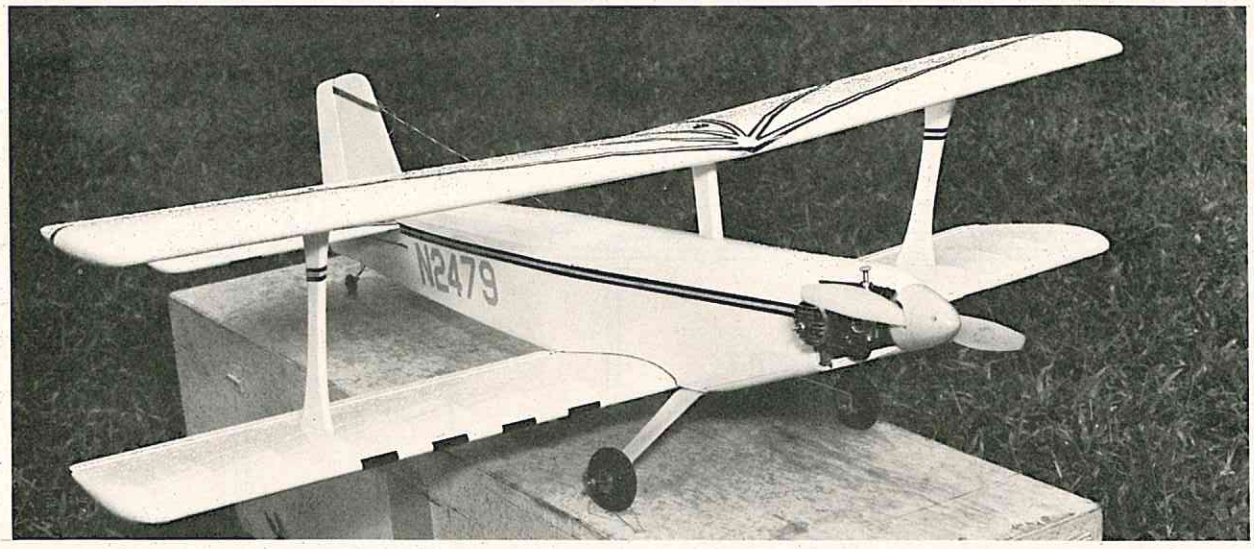
As you can plainly see from the beautiful pictures which were made by my good friend and long time flying buddy, Jim Duckworth, this bipe is very portable. The portability is dedicated to my good friend and flying buddy, Joe Gross, who is presently flying C-141's (the world's largest cargo plane presently in service). As a matter of fact I think you could fly the free-style acrobatic pattern with the "Chigger" while inside the C-141! Oh well, anyway, I saw Joe Cross for the first time after too many years, at the Dallas Spring meet. While there, he convinced me of the need for the "portable", so now you must decide whether you want yours portable or not! Come on and try it. It's easier than you think.





Set the fuselage on a pillow, (so you don't dent the top, Dewey), and fit the bottom wing in the saddle. Glue the Balsa "riser" and the 1/8" plywood plate in the fuselage aft end of the radio compartment. Cut the 1/8" plywood landing gear plate to fit, and then cut the groove in it for the 1/8" plywood tongue which you also cut at this time. Glue the landing gear plate in place, then set the lower wing in place nice and square and mark the slot for the wing hold down tongue. Cut the slot a little oversize and imbed the tongue in Devcon 5-minute epoxy while everything is held in place for the best fit. Later, when the sheet metal landing gear is bolted in place it completes the groove for the wing hold-down. Neat, huh Dewey? I got the idea from my Lanier Citron, which flies great, too! When all this mess is dry, drill right through the wing into the plywood hold-down plate and tap it for a ¼ x 20 nylon bolt – then bolt it down.

With the lower wing in place you now set the horizontal stab in place, true up it's saddle, plank the saddle with 1/16" balsa scrap, and pin the horizontal stab in place. Cut a slot in the stab bottom planking and stab saddle wide enough for your bolt (I used an 8-32 x 2") and about 3/8" long, directly in front of the spar. Pin the vertical fin in place, then carve and pin the fairing blocks in place to be sure they all fit, then



MonoKote the fin and fairing blocks and glue all the resulting mess in place to fit. Now inlay a small piece of 1/16" scrap plywood in place with the blind nut in place as shown on the side view. If you used Devcon 5-minute epoxy you can now glue the front dowel key in place, then screw the hold-down bolt in place and mark the inside of the fuselage for the doublers and install them and the 1/16" plywood plate holding these in place with the hold-down bolt. While this is all drying bend up the tail wheel assembly and mark the fuselage and rudder where it is to fit. Look at the fuselage sideview and notice the tail wheel wire is free to move vertically in the tube far enough to clear the fin keys when the fin is removed. This must be so, or you won't be able to remove the tail feathers we so carefully, step by step, constructed.

Another word of advice while we're at it. I didn't draw in the landing gear on the original plans I submitted to this ding-a-ling magazine for a bunch of reasons. You can use any sheet metal gear you think will work. I used a Midwest Lil Esquire gear on the original. Be sure the wheels are "toed in" a tad. I didn't draw the length of the tail wheel strut because it's super critical and if you don't get it exactly right the relative angle of the chord line in relation to the runway will be unsatisfactory and this plane absolutely will not rise off the ground (ROG). Maybe someday Chuck Cunningham will do a series on the importance of this but, for now, a general guideline would be; the tail must be lower than the nose, so if you're one of those guys who flies your tricycle gear planes with the nose lower than the tail to cheat on touch and go's I'll guarantee the conventional gear bipe will break that egg sucking habit. So anyway, glue the tail wheel assembly on the fuselage, then glue the fuselage bottom aft of the wing in place.

The original "Chigger" has ¼" sheet balsa rib doublers but I think basswood might be better. At any rate, laminate the balsa struts with aluminum tubing imbedded then trim them to fit so both wings are parallel. Yep, no degrees differential, I guarantee it works! Next drill the rib doublers and bend the bike spokes to fit and both the whole mess together. Now cut a hole in the fuselage for the center wing strut and, likewise, install it from the bottom of the fuselage through the tank compartment with the wings in place. Then add the cross-piece and landing gear block support doublers and, lastly, drill and install the bike spoke with the nipple on top of the top wing.

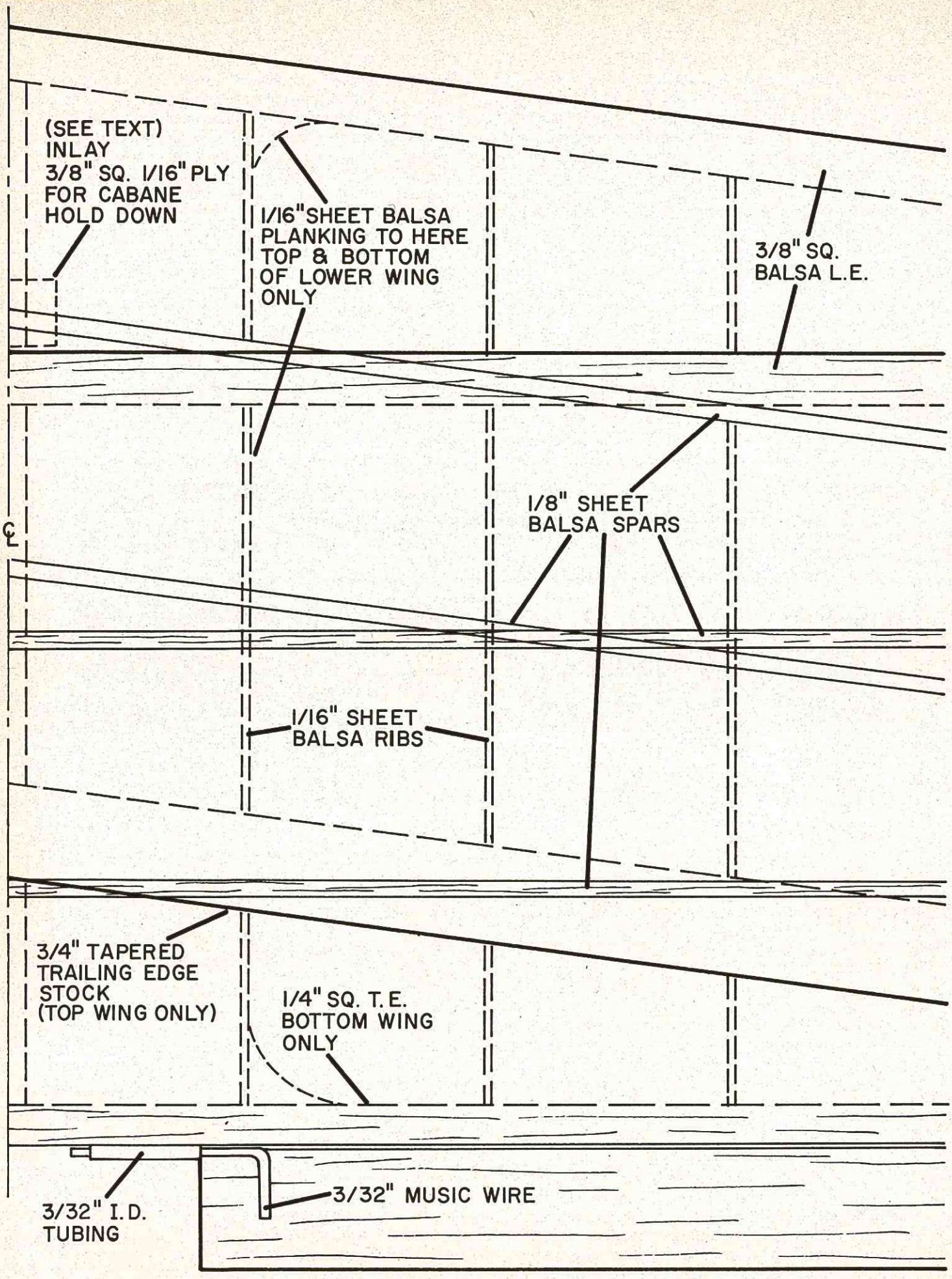
All that's left now is; shape the hatch, cut the angle shown with a Zona Saw, fit the 4-40 hatch hold-down bolts just like you did the wing hold-down bolt, and dismantle and MonoKote the whole ball of wax. Excellent instructions on how to use MonoKote are included with each roll available from Top Flite Models, so I won't go into that.

I really don't know what to tell you about flying a conventional geared biplane assuming you've only flown the trikes before because I've been flying the Goodyear racers for a long time! You might try pushing it and adjusting for straight roll then taxiing and trim it for straight roll. When you first fly it use as large a runway as possible and don't try to correct back to the centerline if it wanders left or right, provided you have the space. Just stop the turn. I suggest you start the takeoff roll holding half up-elevator and don't change until you adjust the climb.

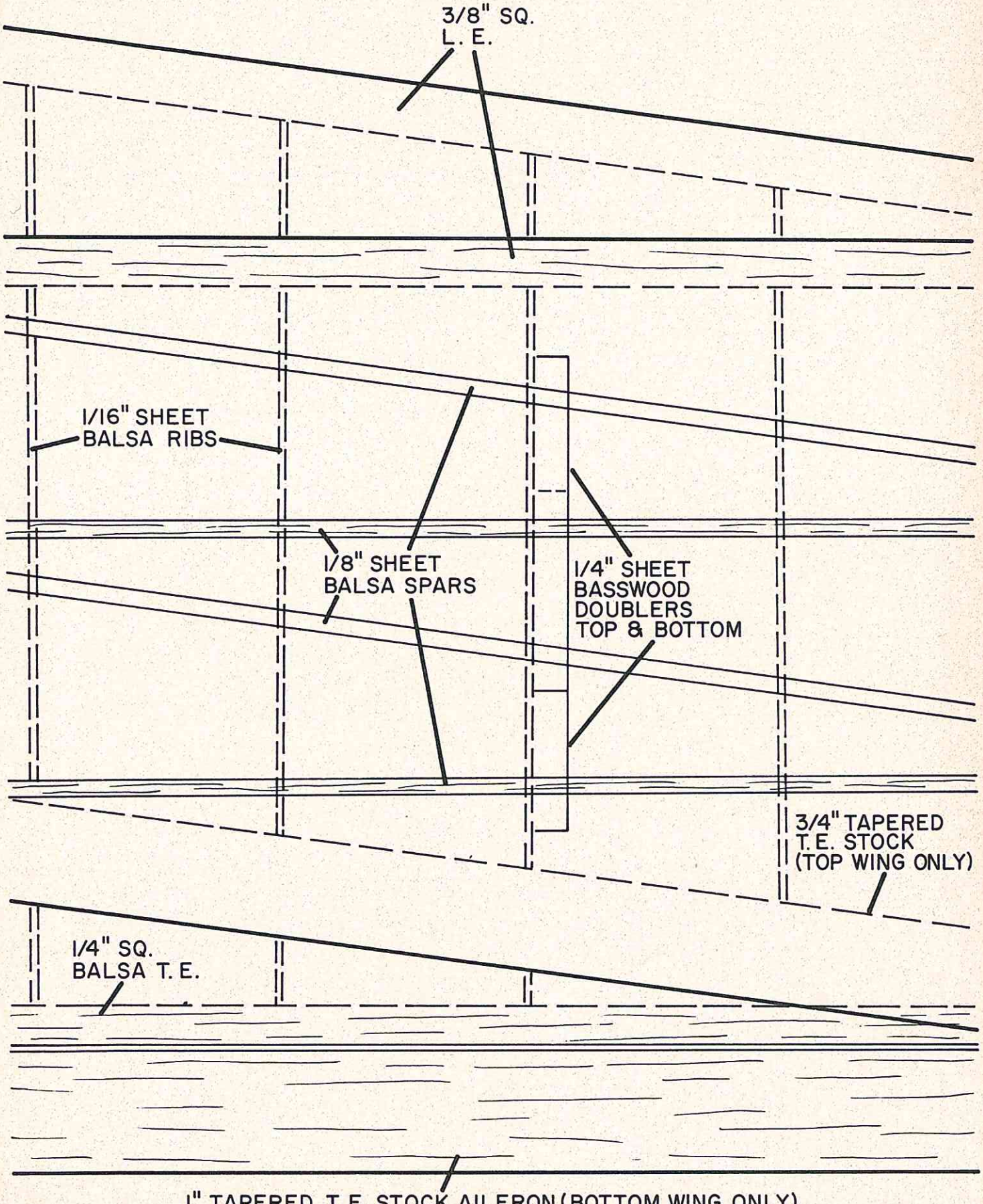
I refuse to be responsible if your CG is other than shown on the plans. I used to fly my designs and add lead to the tail one shot at a time until they wouldn't recover from a spin, then I'd say that was the aft limit! I haven't done that and have no intention of so doing with the "Chigger".

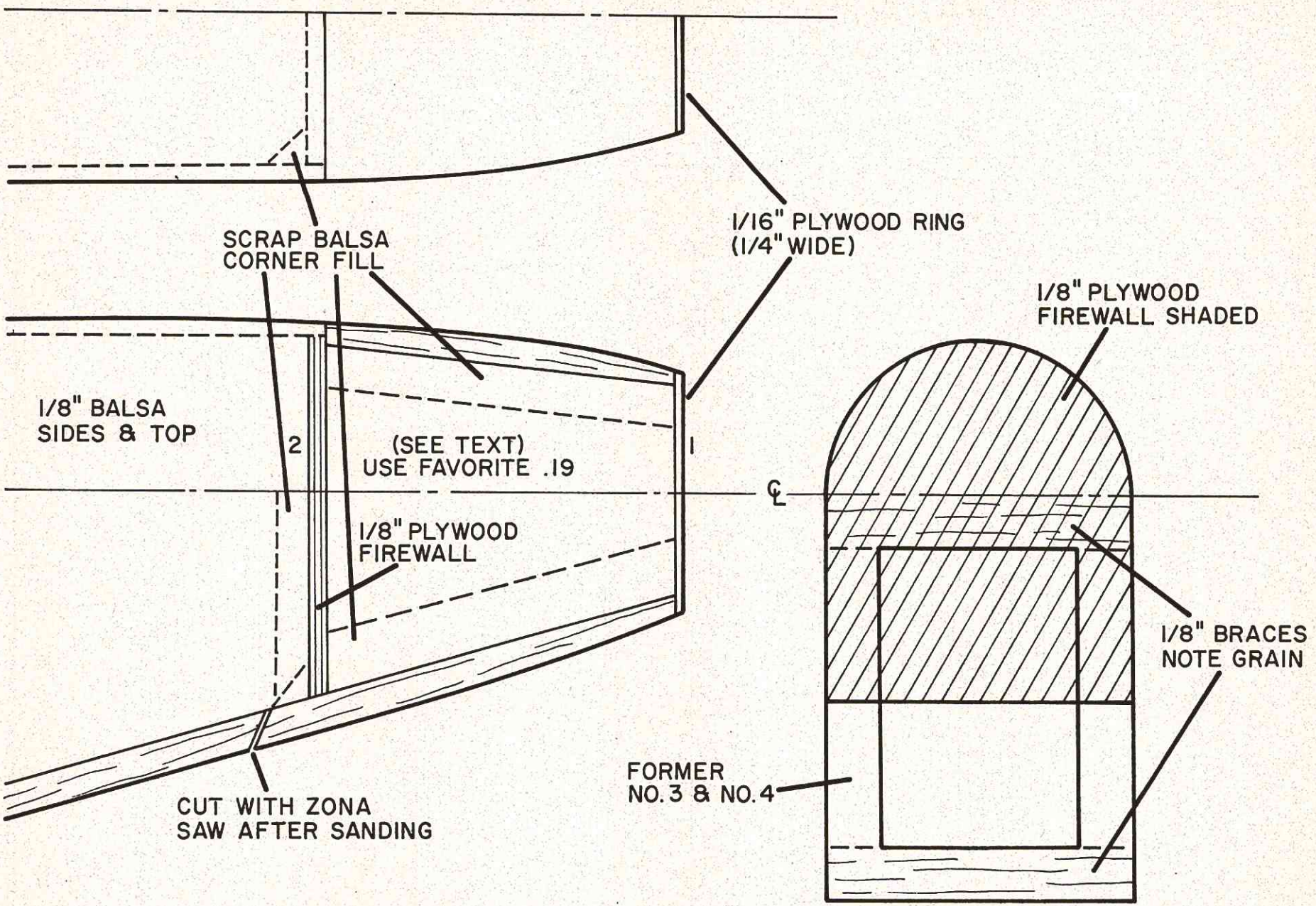
If you do try that – write Don Dewey, you'll be hard put to find someone as nutty as he is!

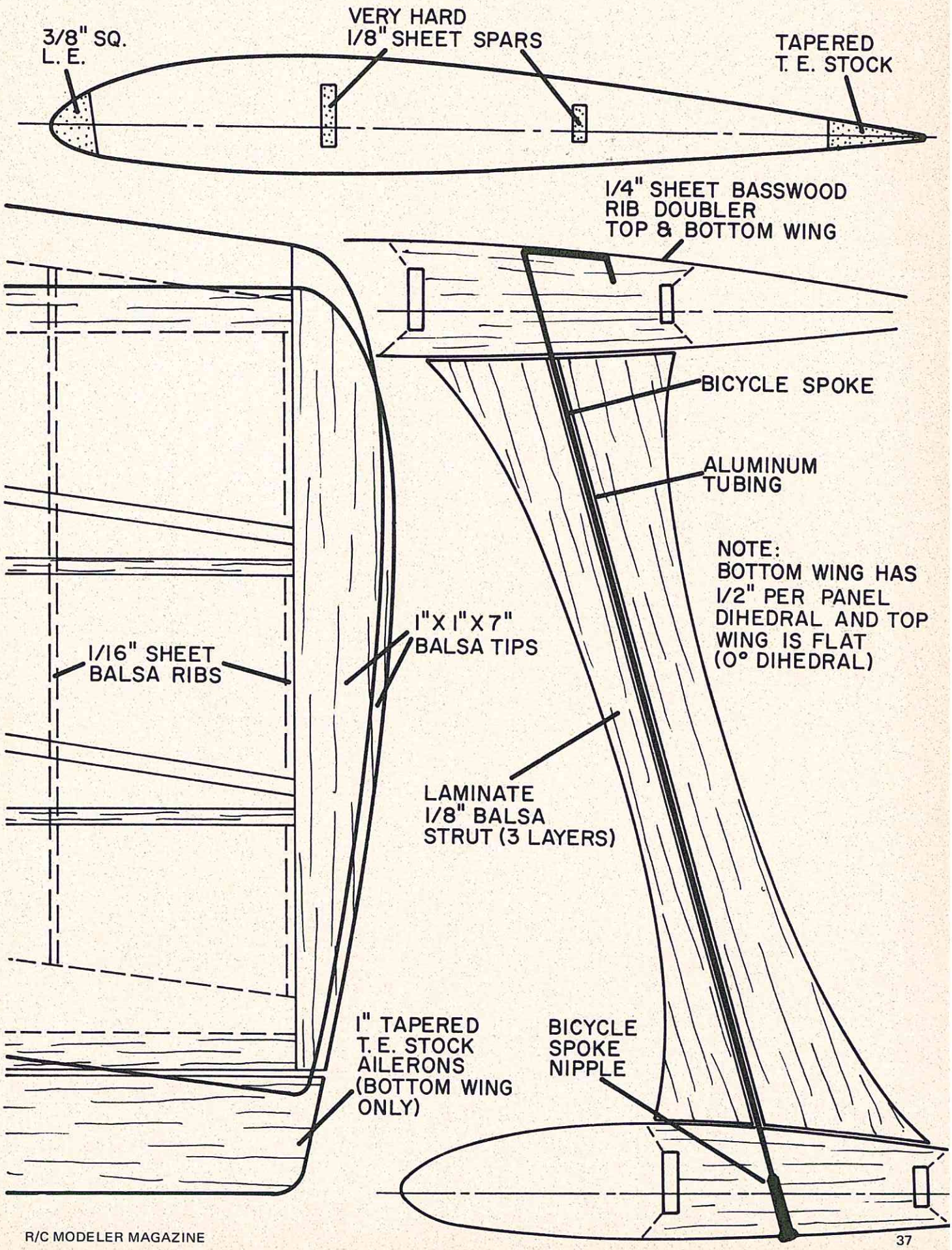
●

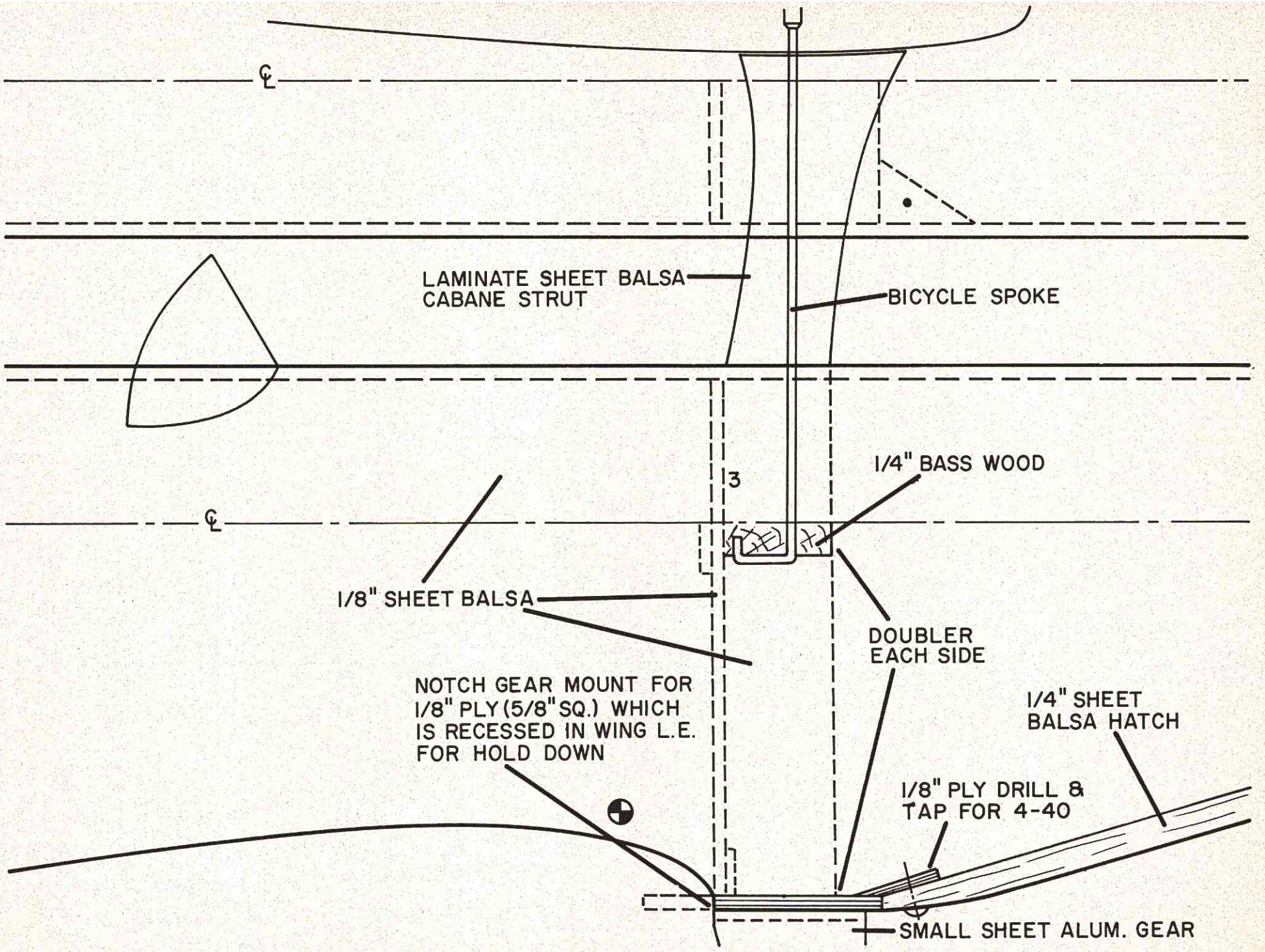

(SEE TEXT)
INLAY
3/8" SQ. 1/16" PLY
FOR CABANE
HOLD DOWN
1/16" SHEET BALSA
PLANKING TO HERE
TOP & BOTTOM
OF LOWER WING
ONLY
3/8" SQ.
BALSA L.E.
1/8" SHEET
BALSA SPARS
℄
1/16" SHEET
BALSA RIBS
3/4" TAPERED
TRAILING EDGE
STOCK
(TOP WING ONLY)
1/4" SQ. T.E.
BOTTOM WING
ONLY
3/32" I.D.
TUBING
3/32" MUSIC WIRE

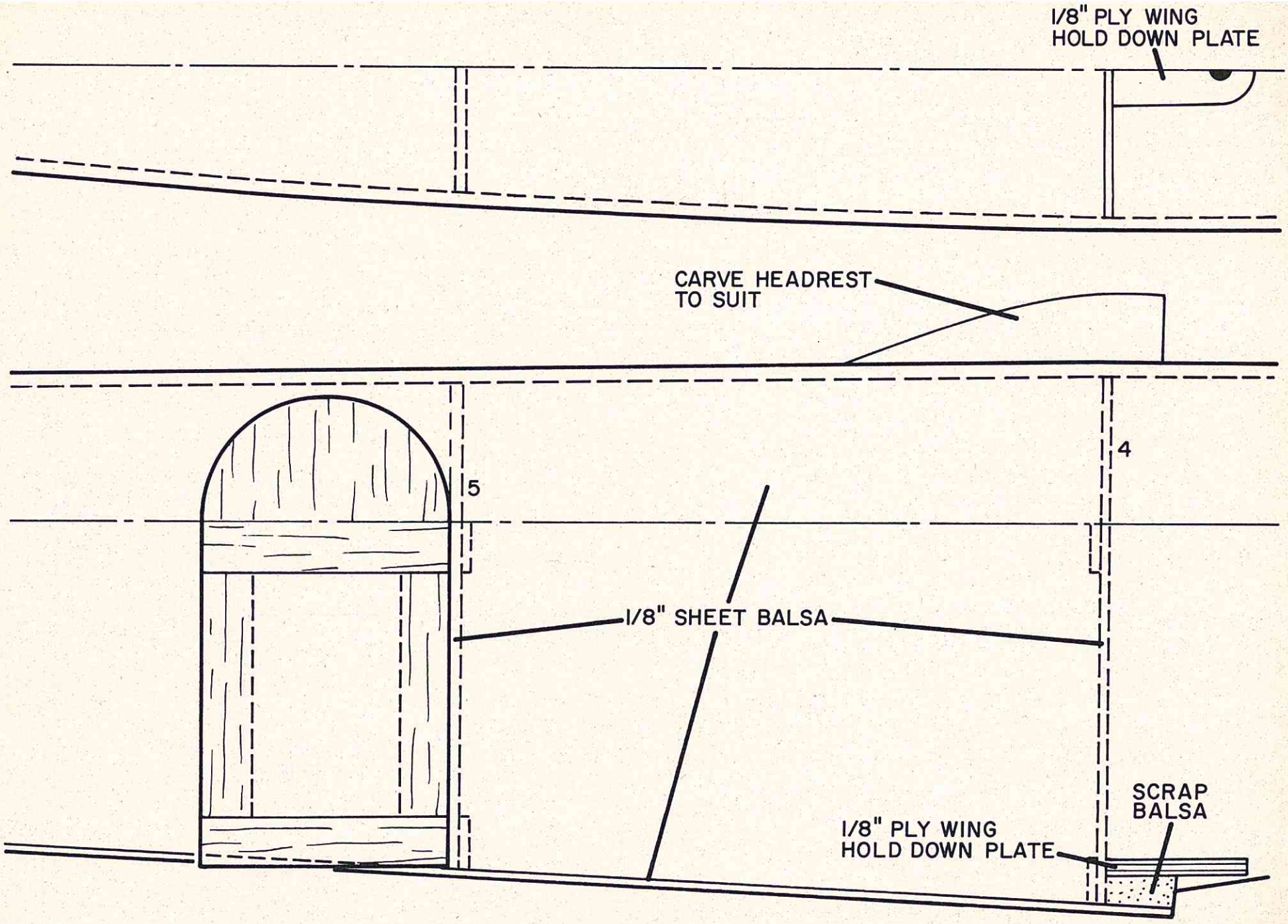
To join wing plan, remove page 34 and 35 from magazine and join together. Remove page 37 and join to right hand side of page 35. To construct fuselage, join top of page 38 to bottom of page 36. Join top of page 39 to bottom of page 38. Join top of page 41 to bottom of page 39.

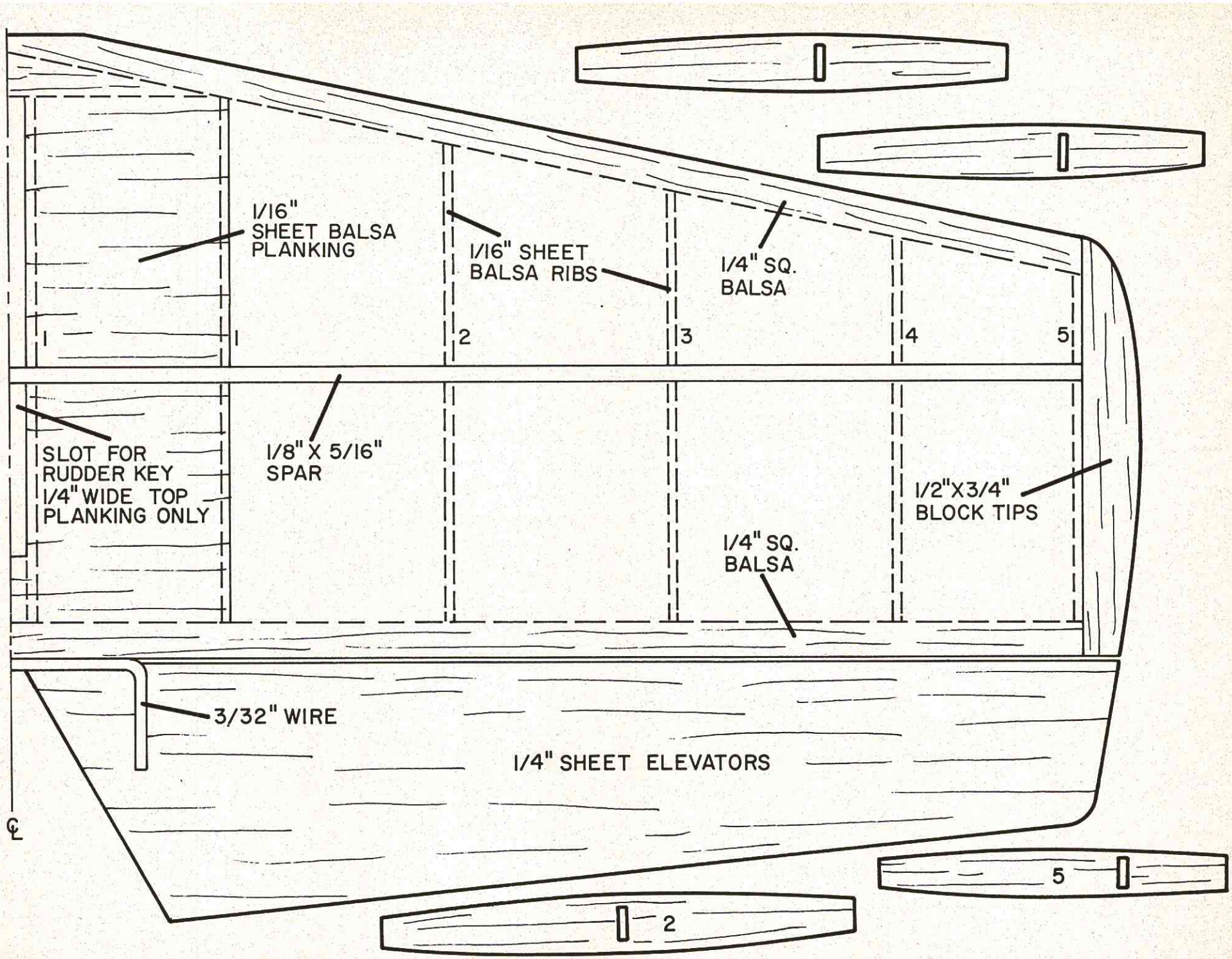


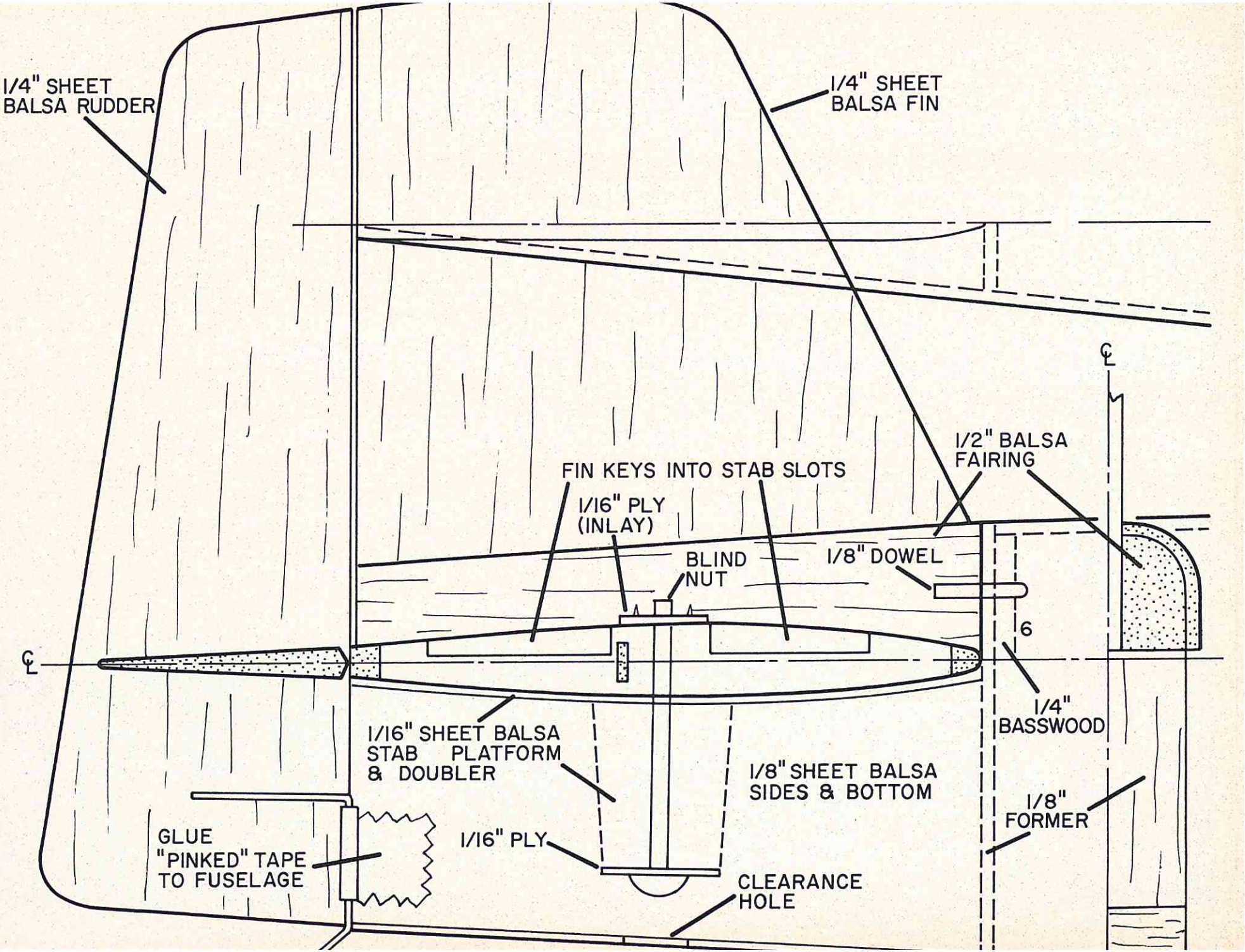

1/16" PLYWOOD RING
(1/4" WIDE)
SCRAP BALSA
CORNER FILL
1/8" PLYWOOD
FIREWALL SHADED
1/8" BALSA
SIDES & TOP
2
(SEE TEXT)
USE FAVORITE .19
1
℄
1/8" PLYWOOD
FIREWALL
1/8" BRACES
NOTE GRAIN
FORMER
NO. 3 & NO. 4
CUT WITH ZONA
SAW AFTER SANDING


3/8" SQ.
L. E.
VERY HARD
1/8" SHEET SPARS
TAPERED
T. E. STOCK
1/4" SHEET BASSWOOD
RIB DOUBLER
TOP & BOTTOM WING
BICYCLE SPOKE
ALUMINUM
TUBING
NOTE:
BOTTOM WING HAS
1/2" PER PANEL
DIHEDRAL AND TOP
WING IS FLAT
(0° DIHEDRAL)
1"X 1"X 7"
BALSA TIPS
1/16" SHEET
BALSA RIBS
LAMINATE
1/8" BALSA
STRUT (3 LAYERS)
1" TAPERED
T. E. STOCK
AILERONS
(BOTTOM WING
ONLY)
BICYCLE
SPOKE
NIPPLE


LAMINATE SHEET BALSA CABANE STRUT
BICYCLE SPOKE
1/4" BASS WOOD
3
1/8" SHEET BALSA
DOUBLER EACH SIDE
NOTCH GEAR MOUNT FOR 1/8" PLY (5/8" SQ.) WHICH IS RECESSED IN WING L.E. FOR HOLD DOWN
1/4" SHEET BALSA HATCH
1/8" PLY DRILL & TAP FOR 4-40
SMALL SHEET ALUM. GEAR


1/8" PLY WING
HOLD DOWN PLATE
CARVE HEADREST
TO SUIT
5
4
1/8" SHEET BALSA
SCRAP
BALSA
1/8" PLY WING
HOLD DOWN PLATE


1/16" SHEET BALSA PLANKING
1/16" SHEET BALSA RIBS
1/4" SQ. BALSA
1
1
2
3
4
5
SLOT FOR RUDDER KEY 1/4" WIDE TOP PLANKING ONLY
1/8" X 5/16" SPAR
1/2"X3/4" BLOCK TIPS
1/4" SQ. BALSA
3/32" WIRE
1/4" SHEET ELEVATORS
℄
5
2


1/4" SHEET BALSA RUDDER
1/4" SHEET BALSA FIN
1/2" BALSA FAIRING
FIN KEYS INTO STAB SLOTS
1/16" PLY (INLAY)
BLIND NUT
1/8" DOWEL
6
1/4" BASSWOOD
1/16" SHEET BALSA STAB PLATFORM & DOUBLER
1/8" SHEET BALSA SIDES & BOTTOM
1/8" FORMER
GLUE "PINKED" TAPE TO FUSELAGE
1/16" PLY
CLEARANCE HOLE

SERVO MAINTENANCE

OR, HOW TO SIMPLY SERVICE A SICK, SLOW SERVO SOONER

By JERRY SMITH

Take a good long look at those servos down in the bowels of your flying machine. Ever thought of cleaning them? Or, are they just another mysterious "black box" and you could care less, just as long as they keep on grinding away at their assigned task?

After the first few flights on your new bird, have you ever noticed the accumulation of dust in the servo compartment? All that dust and dirt throughout the fuselage is brought forth by vibration from the engine. The engine shakes it loose and the air passing by the wing and fuselage joint pulls it into the servo compartment all over your nice clean servos. Under these conditions, it isn't long before the gear train begins to grind and bind.

How about the improperly mounted servo? What does it look like inside after a few seasons of riding around? Let us consider some of the spots that could cause trouble. Undoubtedly, our old enemy, vibration, has done a good job of making a mess of the potentiometer wiper and element. A dirty pot will cause noise,which, in turn, will turn on the amplifier when it is not needed, causing unecessary current drain from the receiver power supply. Another consideration is the servo motor. I have felt, for a long time, that the motor in today's servo is potentially the weakest part. For this reason I pay particular attention to its cleanliness and operation. The "glitches" we sometimes experience (we blame outside interference) can be attributed to a servo motor within our own system. This is not the general rule but it is a possibility. Badly worn motor brushes with burred edges will arc, causing RF noise and, in turn, "glitch" the system. A dirty commutator with poor electrical conduction will cause unnecessary current drain. If the build-up of dirt becomes excessive, the motor will stop. A dirty gear train is another source of trouble. The extra load of binding gears whittles away at the efficiency of your servo causing the motor to use more current. If the gears jam with the amplifier turned on, the inevitable result is usually a "popped" output transistor. A badly worn gear shaft will not let the gears mate properly. This is especially hard on gear teeth and will give intermittent operation.

There are a number of things to look for in order to maintain our servos. One can heed that old adage, "If it works, leave it alone." However, I would like to reword that slightly and say, "If it works, what can I do to make it keep on working?" Let's become acquainted with our servo and learn how to care for it. Then, barring the unforeseen extreme occurrence, we can expect a higher degree of reliability and performance.

The following step-by-step procedure deals with the Orbit-type servo and the Mitsumi motor. Other servos use this motor and are arranged in a similar manner. In general, they all have gear trains, motors, and amplifier boards. Some do not have the potentiometer but, instead, work on the capacitor principle. For all intents and purposes, this procedure should be of some assistance even though the servo is not exactly as shown in our sketches.

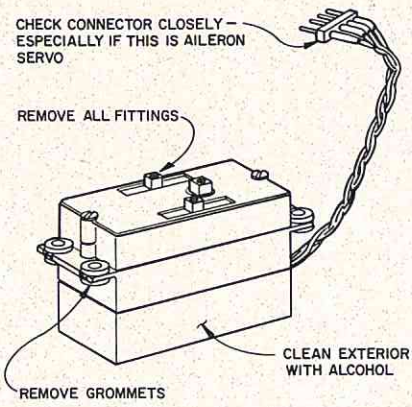
Before starting it is a good idea to pick out a clean spot with good lighting. Start with one servo and become acquainted with the disassembly and cleaning procedure before you lift a tool. The following is a list of tools I find most helpful. You may have your own ideas.

1. Screwdriver (regular – small)
2. Jewelers Screwdriver (removing miniature screws from motor)
3. X-acto Knife No. 11 Blade (removing burrs from motor brushes)
4. Alcohol (general cleaning)
5. 2-Power Eye Glass (visual inspection)
6. Soldering Iron (small with resin core solder)
7. Camel Hair Brush (brush lint from gears)
8. Ampere Meter (check motor current load)
9. Paper Toweling (lint free)
10. Electrical Contack Cleaner ("Wissh" – if not available from your local Radio and TV Service store, write to the Workman Electronics Prod. Inc., Sarasota, Florida.)

PROCEDURE

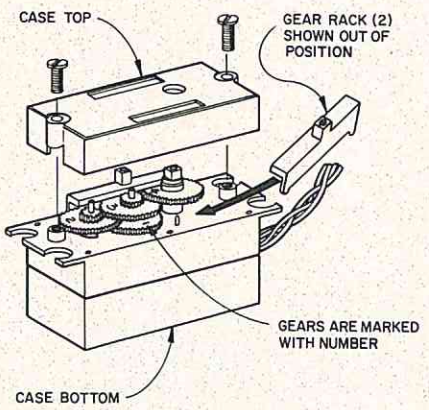
1. Exterior Cleaning. Remove all servos from their mounting place. Remove fittings and mounting grommets,

Figure 1. Clean exterior of servo case with alcohol. Inspect connector for broken solder joints and wires leading to servo for scrapes and nicks. (Note – If this is your aileron servo, check the connector and wires very closely.) If connector is broken or pins are badly bent, replace. It could mean trouble later on.



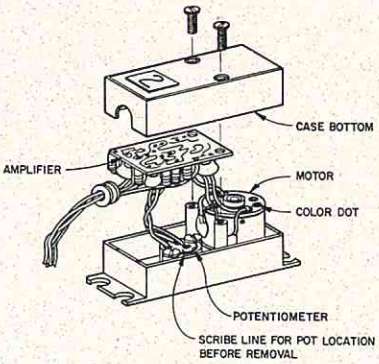
EXTERIOR CLEANING
FIGURE 1

2. Servo Gear Cleaning. Remove screws holding case top, Figure 2. Wiggle top upward and let gear racks fall away. Clean inside of cover with alcohol and dry. Next, clean gear racks and inspect tooth form for wear. (Sloppy aileron linkage causing aileron flutter is hard on gear racks and No. 4 gear.) Remove shaft (pull upward) of gear Nos. 1 and 3. Slide gears out. Clean gears with alcohol and inspect tooth form. Brush with camel hair brush to remove any left over dirt particles. Remove shaft of gear No. 2. Clean and inspect gear. Note position of gear No. 4. Gear must be in this position when gears are reassembled. Brush, clean and inspect gear No. 4. Clean and inspect gear shafts. If signs of excessive wear exist, replace. (New shafts can be made from 1/32" dia. brass rod – available at your local hobby shop for about 15c a foot.) Place all parts in a clean envelope until reassembly time.



SERVO GEAR CLEANING
FIGURE 2

3. Pot Cleaning. Remove screws holding case bottom, Figure 3. Clean inside with alcohol. Pull amplifier out of the way as shown. Scribe line across pot and its housing. Loosen screws only enough to remove pot. Do not unsolder any wires. Clean pot and wiper with "Wissh". Be careful not to bend or damage wiper parts.

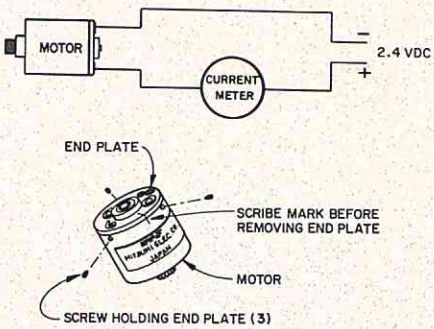


POTENTIOMETER AND MOTOR CLEANING
FIGURE 3

4. Motor Cleaning. Before unsoldering wires from motor note color and position of each, Figure 3. Unsolder wires from motor. Twist and pull upward to remove motor from holder. Motor may or may not have capacitors mounted on it. If so remove only the leads attached to the ground lug. It is not necessary to remove the capacitor leads to motor terminals.

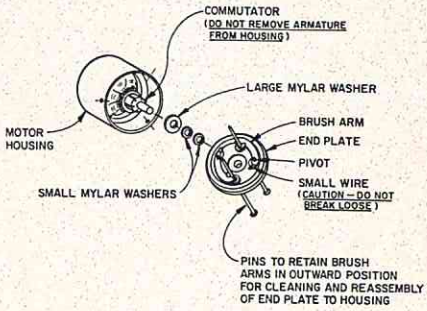
(a) Before disassembly of motor, check the current load. Hook up motor as shown in sketch. Motor should run free at approximately 50 milliamperes on 2.4 VDC. Check again after cleaning and reassembly. You are now ready to disassemble and clean the motor.

(b) Mark case and end plate with a scribe mark, Figure 4. Using a small jewelers screwdriver, remove the three screws holding the end plate. Carefully pull end plave up and tip slightly. Do not try to remove completely. Reach in with a small screwdriver and lift brush arm over large mylar washer. The large mylar



MOTOR DISASSEMBLY
FIGURE 4

washer is pressed lightly on the armature shaft, Figure 5. This is why the end plate cannot be removed readily. Next remove the large and two small mylar washers (some motors will have three small washers).



MOTOR DETAILS
FIGURE 5

CAUTION. Do not remove armature from housing. The brushes are spring loaded and attached to the end plate. **Do not remove from end plate.**

(c) Carefully move brush arm outward and insert straight pins thru holes in end plate to retain as shown in sketch. During cleaning of brushes and end plate be extra careful of the **small** wires running from pivot post to brush arm. These are very hard to see can easily be broken.

(d) Clean armature with "Wissh" or alcohol. Deburr the four edges of each brush, that come in contact with the armature, with an X-acto knife. Clean the brush face and interior of end plate.

5. Motor Assembly. After final inspection of motor for cleanliness, install large mylar washer, followed by two small washers, on armature shaft, Figure 5. Slide end plate over shaft until bottomed on motor housing. Remove pins, one at a time. Brushes will click down into position on armature. Install the three set screws loosely, Figure 4. Rotate end plate to line up scribe mark. Holding down on end plate, tighten the three set screws equally.

(a) At this time check motor for current load with an amp meter. You should have improved it. Reinstall motor back in case with color dot in position shown.

6. Final Assembly. Solder wires from amplifier to motor. Observe proper polarity. Install pot, lining up scribe mark. Tighten the two holding screws. Place amplifier in bottom case, dress all wires to a comfortable position. Make sure grommet on connector lead is in slot on case bottom. Secure case bottom with the two screws.

(a) Turn servo over. Install gear No. 2 with shaft in place. It is not necessary to lubricate gears. Slide gear Nos. 1 and 3

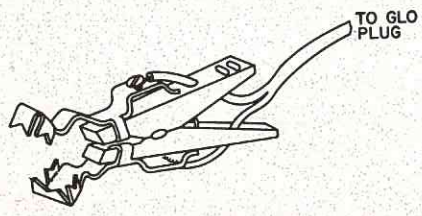
(continued on page 58)

FOR WHAT IT'S WORTH

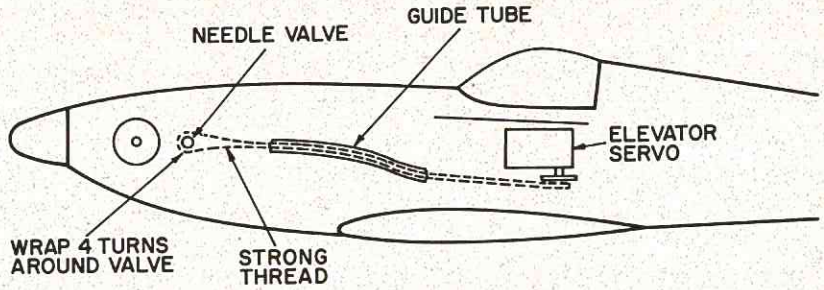
Duie Matenkosky of McDonald, Pa., suggests that a very effective sealer/covering for home-made battery packs can be obtained by buying a can of Scotch (3M) "Skotchkote" electrical coating. This is a liquid vinyl material, and is available in ½ pint cans at most electrical supply houses for about $1.50. To use, wrap the completed battery pack with vinyl plastic electrical tape, and dip the pack into the can of Skotchkote, let dry, and dip again. The result is a one-piece, moisture and fuel resistent flexible convering – it works great!

Cutting silk has always been somewhat of a problem for Ted Pratt of Torrance, Calif. Cutting a straight line is not easy even with the sharpest of scissors. Now these problems are solved by the use of a pair of battery operated vibrator-type scissors designed for cutting out dress materials. Ted bought a Japanese made unit (Spizors No. 600) that cost $2.88. The results of this inexpensive unit are quite fantastic since they cut through the silk like a hot knife through butter. Straight lines and small patches with beveled corners are easily cut with these electric scissors. Every modeler who uses silk and every hobby shop owner selling bulk silk should have a pair. They work equally well on Silron, nylon, etc.

If you're looking for an easily obtainable and inexpensive glow plug clip, this little gadget costs about 25 cents and is used as a quick disconnect for television antenna. Dan Harrison of Palmdale, Calif., has been using one for a starter cell connector for over a year and has had no problems with it. It connects to most two post, nickel cadmium or dry starting cells. If unobtainable locally, try Radio Shack.



Did you ever wonder what to do with the clear plastic backing material that's used to protect Super MonoKote? Alan Wall of New South Wales, Australia suggests using it for protecting plans during construction, or protecting the work board during glueing jobs, etc. It's just too good a material to throw away and, after using the film, there's always some large pieces worth saving.

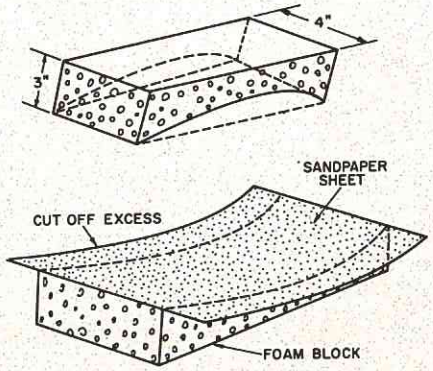


As Goodyear pilots know, one of the problems of pylon racing is the leaning-out effect of high speed turns, which is caused by high G-loadings. This can be overcome by pressure feed, but this, in turn, can cause problems with idle end plumbing. Using a KB.40, C.W. Peake of New South Wales, Australia, has solved the problem by running a strong thread from the elevator servo, through a nylon guide tube, to the needle valve. The thread is wrapped four times around the head of the needle just behind the knurled portion then back to the other side of the servo via the same guide tube. This richens the needle slightly with application of up-elevator. With Chuck's installation, full up-elevator gives 1/8th of a turn of the needle. This seems to suit the K&B, and he can pull a full elevator turn with no sag whatsoever. The amount of needle movement can be adjusted on a rotary servo output in the same way as control surface throw. The four turns of thread provide enough friction to hold the needle in place while still permitting normal tuning. The thread should be inspected and, if necessary, replaced at fairly frequent invervals to avoid breakage in flight. The whole installation is extremely simple and seems to work quite well.

Do you want a use for little tiny scraps of MonoKote left over from your last covering job? Wayne Tilse of Seattle, Washington, wraps one or two layers of the material around a heated screw. Stretch the MonoKote so that it forms on the threads. Overlap the end and wrap counterclockwise looking from the screw head end. This will give you an excellent homemade self-locking screw.

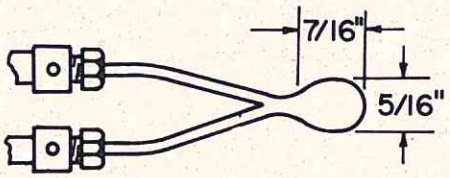
If you're tired of "dinging" the bottom of your wing and fuselage due to your screwdriver slipping out of the slot of the ¼ x 20 nylon wing holddown screws, one solution is to make the slot fit your screwdriver. First, heat up the screwdriver that you use over an open flame and then push it into the slot in the screw. Now, according to Dan Reiss of Marina Del Rey, California, you'll have no more scratches and gouges on the bottom of your wings.

Harvey Mitchell of Lubbock, Texas, submitted a solution for sanding down foam wing cores prior to covering. One of the drawbacks of hand sanding these cores are that if you are not careful, flat spots develop and a generally uneven surface is produced. This can occur with sanding blocks, or without, and even when the greatest of care is exerted. Harvey took a block of foam 4 inches wide by 2 or 3 inches thick and slightly longer than his wings chord and cut a "wing core" out of it as shown in the

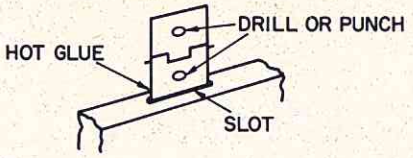


sketch, using the same templates used to cut out the wing. He discarded the "core", leaving a block as shown. The next step is to take the block, sand the edges out of it, and lay a piece of sandpaper inside and measure and cut to the proper dimensions as shown. Now, after cutting the sandpaper to shape, Harvey sprays contact cement on the foam and the sandpaper and carefully aligns the block with the paper. This process takes a total time of about 5 minutes and results in a perfectly contoured sanding block for the wing. You will find that only six or eight strokes with this block prepares the wing perfectly for covering with no distortion. Try it, using full span strokes with light pressure.

Here's two ideas on better hinging from John Blohn of Whitestown, N.Y. One of the easiest ways to slot a balsa surface for controlled hinge is to use your Weller 100-140 watt soldering gun to do the job. Simply replace the standard tip with the Weller tip No. 6110 which fits models Nos. D440, 8100, 8100B and 8200. This part costs about .50c and is available at most local hardward stores. It will also fit the 100-140 watt Millers Falls soldering gun. The size and shape of the tip is indicated in the drawing. Simply line up the spade



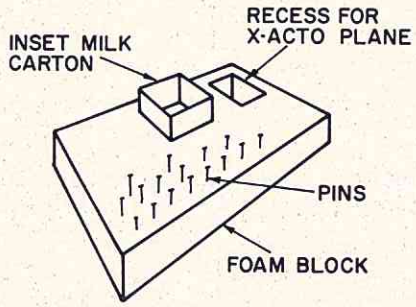
shaped tip, when hot, and push into the balsa. You'll find that it will slice the balsa like butter. The size and depth of the slot is determined by the degree of heat, trying the lowest heat (100 watts) first. A slight amount of charring will occur which is easily removed by sanding. It is receommended that slots be made before painting or covering. This is not recommended for foam surfaces without balsa reinforcements at the hinge line. Now, when inserting your hinges, instead of using epoxy, Silastic, etc., to glue try using an electric glue gun which is also useful for many other building chores as well. Partially insert the hinge (approximately 1/16" into the slot) and lay a bead of hot glue on both sides of the hinge. Push the hinge into the slot while the glue is still hot and soft. This works beautifully on both balsa and foam surfaces. The glue will set up in 60 seconds and any excess



which squeezes out can be easily removed, when cool, with a knife or razor blade. An added benefit of this glue is that it will not bind the hinges like epoxy often does if you're not careful. An extra hole or two in the hinge surfaces will aid the holding power of the hot glue.

Bill Morrison, of Owen Sound, Ontario, Canada, uses the following method for adjusting the air bleed screw on his engine while the latter is running. Bill uses a screwdriver that is longer than the diameter of his propeller blades, and on the end of the driver he solders a short piece of brass tubing over which he slips a piece of plastic tube so that the driver head won't slip out of the slot.

A table "caddy" for pins, rulers, glue gun, X-Acto knife, and other items that usually clutter up your shop table, can be made easily from a 2" x 8" x 10" piece of styrofoam and the bottom 4" of a half gallon milk carton. A hole is cut through the foam to hold the milk carton snugly in place. Placing this toward the edge of the block of foam gives ample room for pins and other small items. The glue gun, etc. goes in the milk carton.



Dick Hill of Laurel Springs, New Jersey, noticed an excellent idea in use at a neighboring club field. It consists simply of a small coffee can which is filled half full of cat litter, a material which is also used to absorb spilled oil and grease at gas stations. When you're finished flying for the day, don't throw those sloppy rubber bands away, but simply put them in the can and shake. You then have clean rubber bands for the next trip to the flying field.

WAGGER

"Dagnab you, you ornery Bassett!" exploded Walt. "I'm getting tired of having you slam our model club every time you open your dewlaps! Suppose you give us a few **constructive** suggestions for a change!"

Wagger cast his bloodshot glance upward toward his master and started to flare, then dropped down onto his 'Livewire' shards instead and gave an apologetic sigh.

"I'm sincerely sorry if I seem to keep picking on your group, Walt, but you guys are so darn narrow in your viewpoint! When you're not working at your job, you're playing with your hobby. Put 'em together and you have the 'Compleat modeler': a guy taking the best of the world and putting **nothing** back into the pot to help other people get something out of life!"

Walt slammed a fist to the table, neatly demolishing the vertical fin for Wagger's latest project. "Suggestions, suggestions!" he repeated.

"Alright," snorted Wagger, "I'll shoot from the lip and you catch whatever seems to fit your situation. "First of all, give some time to the **kids** that you are constantly complaining about! How about taking one Sunday afternoon a month away from your R/C country club and go instead to the local school ground? Fire up an engine to attract the kids, but then **shut it off** and drag out a dozen ready-to-fly rubber models. Fly one yourself, and then help **them** to assemble and adjust one. Sure, some will get smashed and stepped on, but also some of them will outfly yours! Do this at a regular time each month and I'll bet two things will happen: you'll have more kids competing than you knew existed, and **you** guys will go back and dredge up some skills you've completely forgotten.

"From there, be careful: you may find yourselves sponsoring some indoor contests or hand launch glider events once in a while, thereby introducing lots of new folk to the hobby. I know you've forgotten what spectators look like, but you might be amazed how many folks will gather in the local gymnasium to see an event like this. Of course, if you donate kits and prizes to the lads you **could** spend almost as much as you would for a gallon of fuel. Life has its little hazards.

"About that time, you'll find yourselves responsible for a rebirth of ukie

(continued on page 68)

How To Win Multi Contests And Influence Judges

. . . OR, "LOOK OUT, HERE COME DE JUDGE!"

By DOUG SPRENG

Reprinted From 'Radio Control Manual No. 3'

I have been asked by the M.E.E. (most esteemed editor) to 'lay my cupboard bare' of flying secrets so that anyone will be able to win a comp. Being the magnanimous soul that I am, I have consented to do just that. So, hereby and forthwith are how to do it.

Starting with take-off, I'll go through each manoeuvre with you, giving details as to how I think it should be done. Of course, you realize that my opinion may not correspond to that of the judges, but anyway – start yer engine.

Take off

Placing is obvious for take-off – although there are a few little ways you can 'cheat'. I have noticed that most people let the model go straight away from them. This allows the judges to site down the path of the model and any steering error becomes glaringly obvious. I prefer to taxi downwind a ways so that the take-off run is done across the line of vision. Lift off should come just after it has passed in front of us so that the judges can see the nose leg lift first. Standard technique for take-off is to apply a slight amount of up at the start of the run and hold it 'till the model rotates and lifts – then adjust the amount of up to maintain a nice shallow climb. When the model has gained approximately 25 ft. of altitude call the manoeuvre complete. Make sure the wings are level and the rate of climb constant and not excessive. In other words, emulate a '707', not a Saturn V like some people I've seen.

Double Stall Turn

Theoretically, you fly at about 50 ft. altitude and fairly close in – but *not* overhead. That strains the judges epiglotis. After passing in front flying straight and level, call start of manoeuvre. In very windy weather fly upwind considerable more so that the manoeuvre isn't blown downwind past you. To start pull up *gradually* not with a great heave. As you pull up it is extremely important that the wings are dead level or very slightly right wing down. If the left wing is down hell will freeze before you'll do a right hand stall turn. Upon obtaining vertical flight start gradually backing off throttle and applying right rudder. If you time this just right three things should happen simultaneously.

1. Model airspeed is zero.
2. Rudder is fully applied.
3. Throttle is almost fully closed.

Never fully close the throttle! How is the model gonna swing its rear to the left if there's no breeze over the rudder. It takes about 3 to 4 thousand R.P.M. worth to do it.

After the model has recovered and stopped wagging its tail, apply full throttle and get set for the half outside loop. Again don't let that left wing droop during the outside ½ loop or you'll 'Spreng'. The bottom of the ½ loop should be at the same altitude as you entered the manoeuvre. This is very difficult to do, but judges always twig it. The second half is a repetition of the first half except that you now apply *left* rudder and you have a second chance to blow it.

Double Immelman

This isn't too difficult to do except during the roll-out of the outside immelman. Chaps tend to climb or dive during the roll. I find it helps to retard throttle during the outside half. This slows things up enough to do a decent axial roll at the bottom. The amount of time flown between the inside and outside immelman depends on the wind. I like the manoeuvre to be shaped such that if the first half loop was continued the manoeuvre could be converted to a horizontal eight, in other words the loops just touching. I am not in favour of hesitating before the roll. The roll outs should be staggered slightly, not one above the other.

Three inside loops

This is a schoolboy manoeuvre and never usually gives much trouble except in windy weather. The technique is very simple in theory but difficult in practice. You merely tighten the loop at the top – and loosen it at the bottom. The wind will not take your distorted loop and blow it round again. Most people are doing nice large loops now and all placing them better than me so I'll comment no more.

Three Outside Loops

Same as above only upside down!

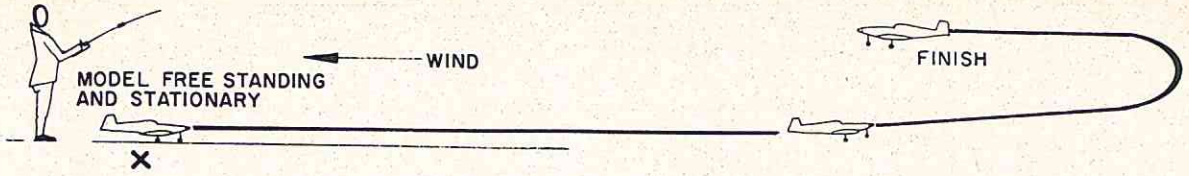
No, actually the technique with the outside loop, or bunt as it is called, is to enter the manoeuvre going downwind. In this way, the wind helps in the climb out from the inverted position. Use of the wind direction in this way, helps to keep the manoeuvre tight and circular. If you've watched a bunt done from the into wind position, you will know how the wind strings out the back half of the manoeuvre. Shape your three consecutive outside loops, circular around an imaginary point in the sky by releasing the down elevator slightly at the bottom. In this way, you will achieve the superimposing of the three bunts as required.

Three Consecutive Rolls

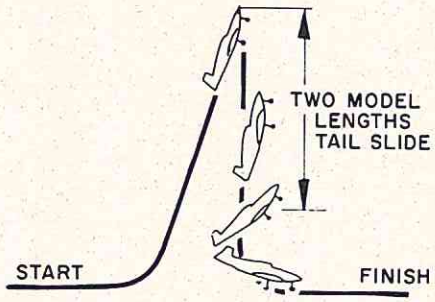
I don't have a clue why people insist on doing this manoeuvre down wind. It's ludicrous, whatever that means. It also wastes a lot of time in windy conditions and that throws the whole pattern out of rhythm. All this time you're flying upwind the judge is thinking, 'you know, that last manoeuvre was too close, or too high etc.; I'll really watch the rest for this fault'. Don't give a judge time to think! Keep socking it to 'em! Come out of the 'bunts', fly straight and level and split 'S' into the rolls. Do 'em, then fly straight and level until way upwind, execute a pretty climbing reversal into the next manoeuvre.

Slow Roll

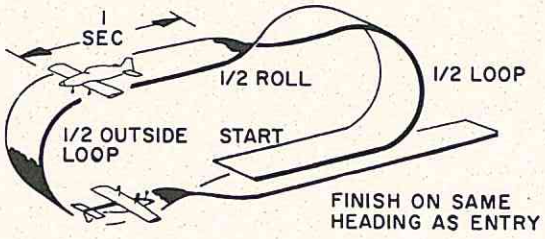
I prefer to use rudder in the slow roll. I know it's difficult, but when it comes



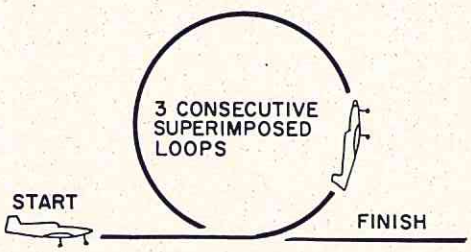
TAKE OFF



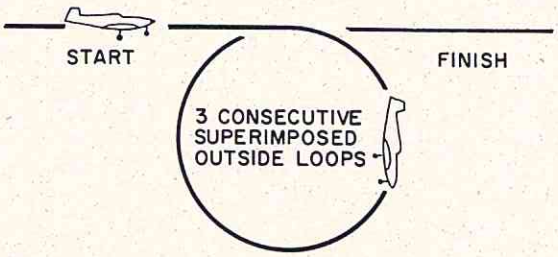
TAIL SLIDE



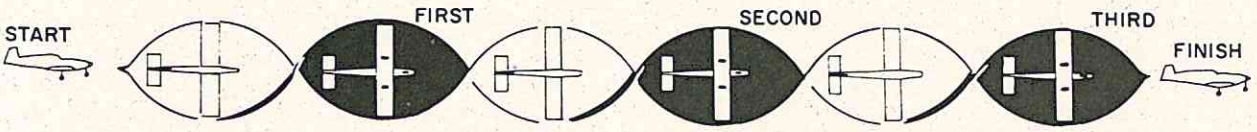
DOUBLE IMMELMAN



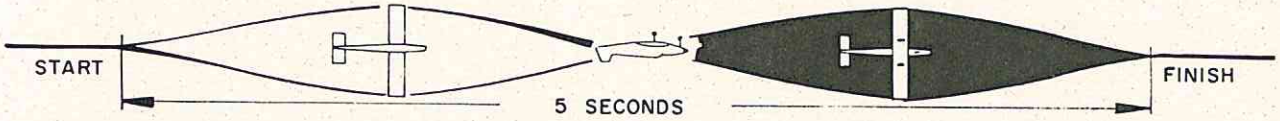
3 INSIDE LOOPS



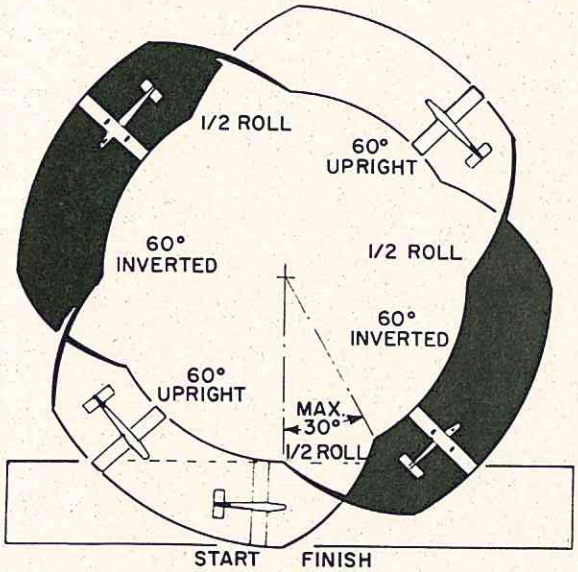
3 OUTSIDE LOOPS



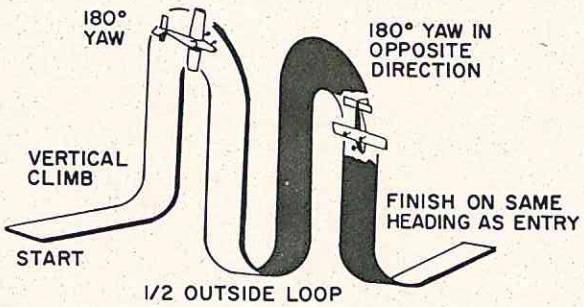
3 CONSECUTIVE ROLLS



SLOW ROLL



ROLLING CIRCLE



DOUBLE STALL TURN

off good it's a real jaw dropper, and the points pour out like pints. So remember, if you roll to the right, apply *left* rudder during the first 90 degrees (be sure to neutralise rudder while inverted) then apply *right* rudder during the last 90 degrees – simple, eh?

Rolling Circle

Not many hints here except a crucial one. This stunt may be started upwind or downwind depending on whether the wind is coming from the left or right. I always do it counter clockwise. This is the way I learned it and I'm sure if I tried it C.W. I'd crash. If I'm doing it upwind I delay the first roll a little – if downwind I start the first roll early. It's hard to get 90 degrees increments, especially if flying at an angle to the runway. Most people (including me) tend to leave the last roll till too late then have to hurry the last circle increment. In windy conditions it's impossible to fly the manoeuvre with a constant angle of bank. The bank angle must be changed to suit the wind i.e. when flying upwind *less* bank, downwind *more* bank. Like the loops, this is the only way it will be round.

Tail Slide

The tail slide has been called the pure luck manoeuvre, and with some justification. Start from the horizontal position going downwind lift the nose, and progressively close the throttle until the model hangs motionless vertically with the throttle fully closed. The model then drops backward three fuselage lengths before recovering in the direction of entry. The trick is to achieve those three fuselage lengths of drop without the model dropping over backwards, and this is why it is called the pure luck manoeuvre. It is rarely, if ever achieved and the best course if in doubt is to get the entry and exit right, avoiding the model toppling over backwards. In this way you get some marks – if it topples over backwards, you get a big zero.

Horizontal Eight

Gripe, gripe – I'm always calling other peoples' faults yet they keep beating me! The most consistent fault in any manoeuvre occurs in this one. Yes, I'm speaking of the first crossover not being dead vertical. The second one always is. The first one? NEVER. People keep telling me it's because the wind is blowing and the plane has to have an angle to drop straight, but I maintain that the craft is not in that position long enough for it to count if the manoeuvre is done correctly. It is an 'instant transition' from inside to outside – but I've seen internats class flyers spend a seeming eternity screaming at the ground at an eighty degree angle. Never see them go beyond vertical on the back half either – logic says they should.

Cuban Eight

Nothing much to comment here except that I prefer to fly straight a bit before and after the roll. This is a personal preference and it goes against the rule book illustration, but it tidies up the thing and gives it a look of precision and rhythm. It can be done up or down wind, but again saving time, since the tail slide is done down wind, the horizontal eight should be upwind which means that this one should be downwind which leads us to the next manoeuvre:

Vertical Eight

This should be done upwind. The object is to never fly past without doing a manoeuvre. Just streak back and forth doing the good things. Obviously the approach to this one is via an immelman. Yes I've seen many an ace get shot down by starting this one too low.

Inverted Straight Flight

It just so happens, that this manoeuvre following the vertical eight is a real pretty fly-by type. Continue upwind at a constant altitude after the vertical, and then do a roaring reversal smack into the inverted flight (not the ground). Call it roll it, fly it, and nice and *low*. This shows off the manoeuvre. It should be done down on the deck; low inverted pass sort of thing – lots of fun!

Inverted Eight

A climbing turn follows inverted flight. Get back up to about 50 to 100 feet. Start the manoeuvre directly over-head, to hell with the judge's epiglotis. Be rolling inverted just as you pass overhead. If you're going to turn left (which you better since the 'book' says so) roll right into it. This way you do less than one complete half roll. As in the rolling circle, the bank angle must change to make it round in wind. Flying upwind, little angle flying cross to downwind, lots! Just remember, unroll into the wind and you will be OK.

Top Hat

The approach to this one is a big 'S'. This manoeuvre should be done upwind for this reason; after the initial climb and roll the model has little speed left, and it helps to go inverted into the wind. Now, I can hear the tongues wagging, saying that it shouldn't make any difference, but, unlike the horizontal eight with its transition vertical, this vertical is for keeps, so should be flown at an angle of attack so as to make the ascent truly vertical. Under these conditions it is better to do it upwind. Yes, the descent, back half, should be beyond vertical (and on low throttle).

Spins

Yes – everybody can do a spin. The trick is to do exactly three turns! It looks good to let the model dive a bit after the spin, and recover gradually.

Rectangular approach

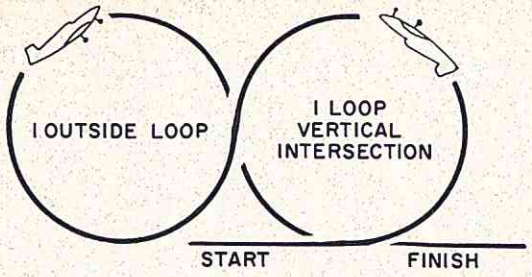
Now, if you have done all the things I suggest to save time, you won't have to hurry this one. The biggest thing here is to keep the turns crisp, loose altitude gradually (not in lumps), and above all make the base leg square – not round like many do. If you have judged your turns just right you'll be all lined up for landing.

Landing

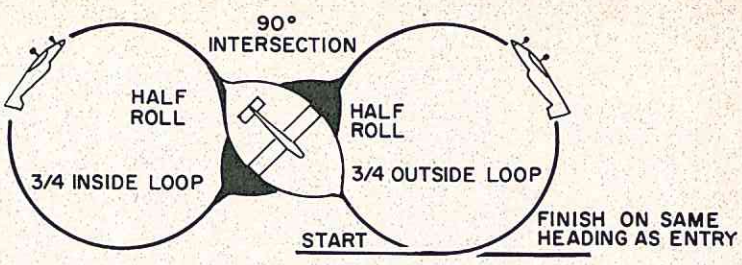
This is one of the most trying manoeuvres. One sees very few really outstanding landings at a comp. The approach should be gradual in loss of altitude – there should be an obvious flare – touch down should be on the main gear with nose high – roll out should be straight – and the model should come to a complete stop in a reasonable distance. This would mean brakes should be fitted. Judicious use of throttle helps here. It's also good to have idle cut-off on trim. I normally fly with engine trim in full high – pulling trim to full low stops the engine. One approach, just after the last turn, I like to get the model all slowed up by fully retarding the throttle and gradually feeding in up elevator. When about half up travel is in, I use throttle to keep the descent gradual. Flare-out is a cinch now by retarding throttle fully and feeding in the rest of the up. The object is to touch down just as you reach full up elevator. Of course touch down should be on the 'spot', this is the hard part.

Conclusions

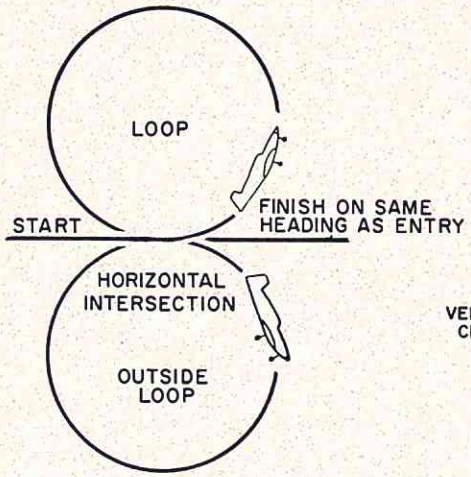
An aerobatic schedule is like a melody – it has rhythm – a bridge – a chorus. Done properly, there is never a dull moment – it's a work of art and a joy to behold. Remember – its the little things that count – stand close to the judges – call the manoeuvres loud and clear – remember to allow straight and level flight before and after the manoeuvre. Above all, when out flying for fun – don't just buzz around – fly complete patterns – memorise it – get to know it like an old friend. ●



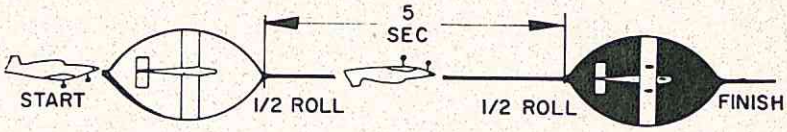
HORIZONTAL EIGHT



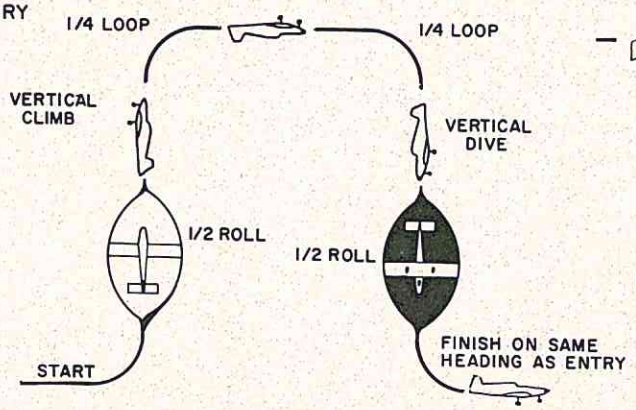
CUBAN EIGHT



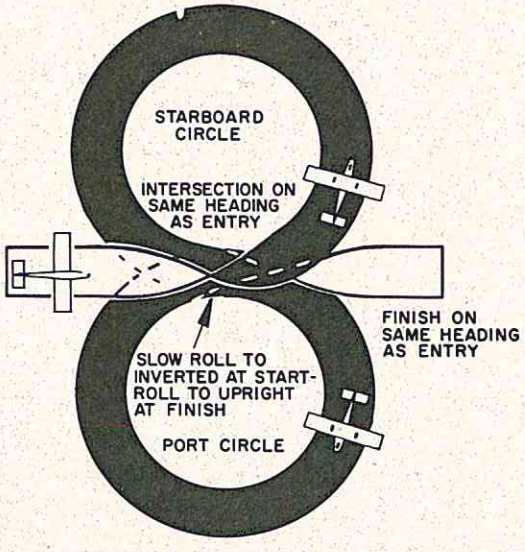
VERTICAL EIGHT



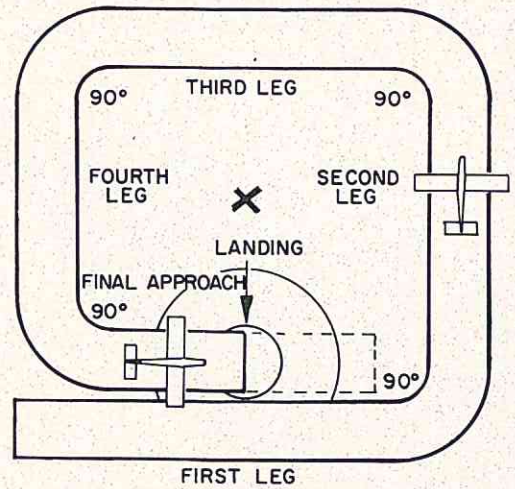
STRAIGHT INVERTED FLIGHT



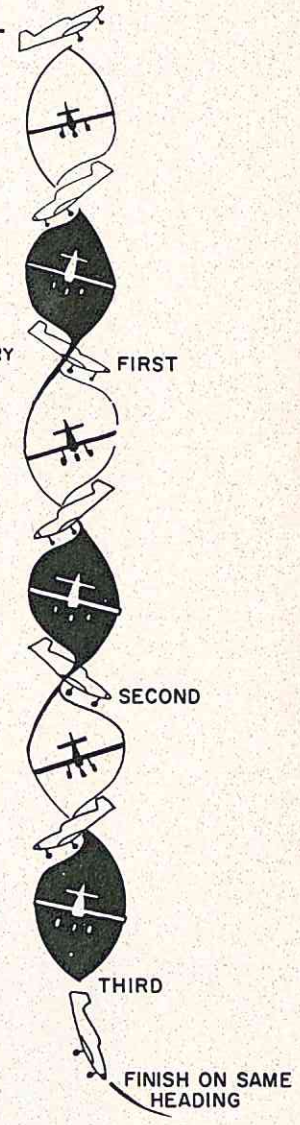
TOP HAT



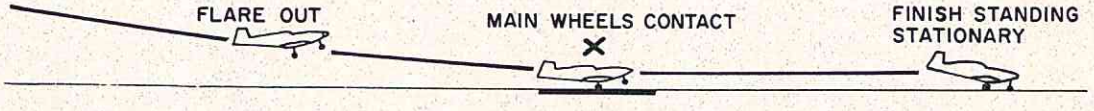
OVERHEAD EIGHT



LANDING APPROACH



3 SPINS



LANDING

KITS & PIECES

DICK SONHEIM

Product 60's beautiful Beechcraft Bonanza V-Tail.

I just finished attending the first trade show of the new year held at the Orange County Fairgrounds in California. In addition to seeing the many great new things the manufacturers will have for us this coming year, it was also a wonderful opportunity to visit with many of our old friends, particularly those from the East who came to enjoy the California sunshine. One of the latter, a great guy who I use to see on the flying fields back in New Jersey many years ago, and known to most of you as the RC editor for Model Airplane News, Art Schroeder, I met this year on the flying field of the Orange County Fairgrounds. To prove to each other, after these many years that we could fly something other than a tube type single channel radio, we took turns flying Paul Sherlock's LearJet. And let me tell you we had a ball! Not only does this radio controlled version of the LearJet look impressive while it is flying, it is a joy to fly as well. The model handles as well or better than most sport planes and will perform most of the stunt pattern maneuvers as well. It is quite something to see a LearJet do a knife edge flight from one end of the field to the other!

It looks like the trend in this hobby will be "more of everything for everybody". For the fliers there will be more of the plastic type 'almost-ready-to-fly' airplanes, from the LearJet type to the fiberglass fuselage models with completly balsa covered foam wings, such as the type being imported from Germany by Jerry Nelson. For the builder there will be more balsa kits and scale kits such as the Alon Aircoupe by Jack Stafford Models. Two of the radio manufacturers, Orbit and Kraft have added 'buddy box' plugs to their transmitters. This feature will enable any two transmitters, regardless of their frequencies, to act as either a master or a slave unit, by simply flipping on a switch on the bottom of the transmitter.

There are a great many fliers who buy ready built airplanes or have their own personal builder who, for a fee, will build custom-built models. For those RC sportsmen who are willing to pay the price for ready-to-fly airplanes here are a few people to write to: Custom Built Models, 1703 Cambridge Dr., Cocoa, Florida, who will build any RC plane from any kit or set of plans. North Shore Models, 25 Locust Road, Northport, New York 11768, carries about 40 complete ready-to-fly airplanes in stock, including Goodyear, Scale, stunt, and sport types. Nashville Hobby Center, 903 Church Street, Nashville, Tennessee 37203, also has a large selection of ready-built airplanes and, if they don't have what you want, they will arrange to have it built for you. Unfortunately, nowhere in either the literature or the lists of airplanes in stock is there any mention of price.

If there are any other modelers out there who build commercially send me your name along with some examples and prices and we will try to pass the word along.

NEW PRODUCTS

Product 60 Hobbies, P.O. Box 19133, Salt Lake City, Utah 84119 announces that it is in production with two new plastic ready-to-fly airplanes in the .35 to .50 engine class. The Product 60 Beechcraft Bonanza Aerobatic will be $69.95 plus $3.00 shipping and insurance, while their Beechcraft Bonanza Vee Tail will sell for $79.95 plus shipping and insurance. An inverted engine configuration, producing a realistic scale nose appearance, will be sold only as a custom plane for the discriminating buyer. A Veco .50 RC with a Perry carburetor, complete with all linkages and fuel system must be installed at the time of manufacturing for an additional charge of only $45.00.

C.B. Enterprises, 15713 Via Represa, San Lorenzo, Calif. 95480, is producing the new C.B. carburetor for $19.95. This is the carb that the Formula I boys are using on the West Coast. In addition to the normal carburetor the C.B. unit has a servo controlled needle valve. The C.B. carburetor is available for most of the larger size engines. Be sure to specify your make and model when ordering. Clarence Lee will be giving you a further report on this item in his Engine Clinic column.

M & M Enterprises, 14810 McVay, San Jose, California 95127, has recently marketed a giant RC sail plane, called the Nuage, and priced at $39.95. The kit features a 105 inch foam wing, fiberglass boom, V tail, and formed steel wing rods.

Top Flite Models, 2635 S. Wabash Ave., Chicago, Illinois, has taken their famous Nobler U-Control model and converted it to RC. The RC Nobler has a wing span of 51 inches and will weigh 4½ to 5 pounds using a .35 to .45 engine. As with the U-Control version, the RC Nobler kit includes the same mechanically coupled flaps and elevators. The kit comes complete with all hardware, including a built-in jig to insure perfect straight wing construction. The RC Nobler kit will sell for $27.50.

(continued on page 58)

GEMS

(continued from page 6)

nervousness you feel is self-generated so take a deep breath and get control of yourself, or you'll have only yourself to blame. The key here is to relax and anticipate.

All the beginners we've taught, to the man, have grossly overcontrolled their planes as they first began to fly. Many instructor pilots say the same is also true of their student pilots. Here is a trend you may anticipate. Concentrate on flying **gently**. When you get it up make **smooth**, shallow turns and your chances of success are much greater. The coined phrase for this gross overcontrolling is "ham fistedness". As long as you're gonna participate in our sport you may as well learn all the big words!

OK, now you're out on your selected flying site, your plane, engine and radio all work well, there is a gentle breeze blowing and you are so cool you know it's time to fly. Walk out into the geographical center of your flying area and look all around you.

Let's say the wind is from the east so, as you face into it, you see there are no obstructions to your intended flight path. There is, however, a hazard and that is the klong we previously spoke of. That means you can't throttle back and land straight ahead if you have trouble, or your bird is lost.

To your left is a line of trees so, after takeoff, you must climb to an altitude sufficient to clear the trees before you can turn left, or you must turn inside of 'em. (Not recommended).

To your right it is clear of obstructions but there is the klong, also. So, if you aborted your flight immediately after takeoff you couldn't turn right as well as not go straight, so what to do? In this case turn left and crash land in the trees if unable to return to the field. The point is, consider **all** your alternatives before your first flight. **Look around!** Be **aware** and **prepared!** Have a **plan!** The poorest plan is yet infinitely better than no plan at all.

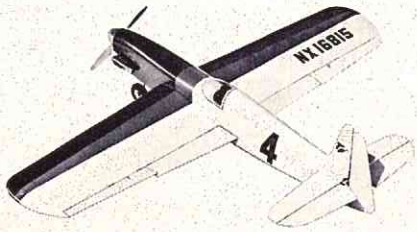
Now that you have a way to takeoff and climb look where you are going to fly a rectangular pattern which will be parallel to your runway and, preferably, aligned with the breeze. Why? Well, you can fly the pattern any old way you want and it won't affect your plane's flight except with relation to you and other objects on the ground! In our case those objects are two clumps of trees between which you must fly to land on your runway. If you're lucky, and the wind is directly down the runway and between the trees, it will be easier to fly an approach to landing. But suppose it isn't. If at all possible go to an airport and watch planes fly over and see the wind's effect on planes. One look at it happening is better than three books on the subject.

No matter, what actually happens when you fly your plane in relation to these trees and your runway is that the nose of the plane will tend to point straight into the wind. But ONLY IN RELATION TO THE GROUND. The wind and associated phenomena are the subject of a future series of articles so, for now, let's just learn to take off and land heading as nearly into the wind as possible.

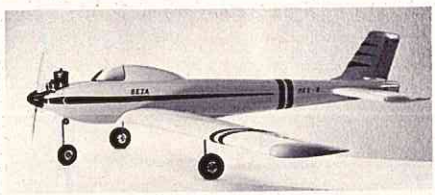
The easiest way we know for your to control your plane as it is coming toward you is to turn around and fly "over your shoulder" so left's and right's aren't mixed up. Then as your plane comes down you can correct, as necessary, to land it as described in a previous article. Then if you goof and hit yourself while turned around .....!! ●

KITS & PIECES

(continued from page 54)



After taking some time out to race full scale boats, Don Brown of Dee Bee Electronics, West Lamb's Road, Pitman, New Jersey 08071, announces that he is back in business with a new line of plastic ARF airplanes. For more information and prices write directly to Don Brown.



Taran Products, 466 Giannini Drive, Santa Clara, Calif. 95051, has a number of new items that should be available very shortly at your hobby dealer. The first item is the Posi Grip control stick that sells for $1.50 a pair, and replaces the plastic knobs on the Kraft-Hayes type control sticks. The second item is the wing lug kit for $1.25 which includes two nylon screws, washers, and blind nuts. The third item is an easy flex hinge that sells for 12 for 65 cents. This is a very flexible hinge material that Taran says will accept most common model cements.

●

We ran a little short of time this month, however, next month we will cover the construction of Sig's Yak 18 PM Scale model with the help of pretty Loretta Hall of the Valley Fliers. Also to be featured will be Midwest's kit of the Flea Fli+10. ●

SERVO MAINTENANCE

(continued from page 43)

into position and install shaft. Make sure both shafts are bottomed. Gear No. 4 should be in original position. If not, servo will have to be recentered. Follow manufacturer's instructions for centering servo.

(b) Install gear racks by holding in place with thumb and forefinger. Hold top case over gear racks to help center. When centered, press case top in place and secure with screws. A word of caution – do not over torque these screws as it will cause the gears to bind. This completes the cleaning of a servo. Plug in and check for operation.

RANDOM NOTES

It is a good idea to have extra parts on hand. An extra case with gears and motor could keep you flying. These are available and can be ordered from the manufacturer of your radio gear.

I like to keep track of my servos. For this reason I number each one and keep a record of its function (where it was used) and any remarks that will help retain some history. In this way you can keep the more reliable servos on the more important functions, such as aileron and elevator.

Admittedly, this sounds like a lot of work to go through in order to maintain a servo; however, the proper maintenance of your equipment is most important. Taking a little extra care will pay off with many added hours of flying pleasure plus that extra bonus of eliminating a costly repair bill. HAPPY FLYING! ●

(continued from page 14)

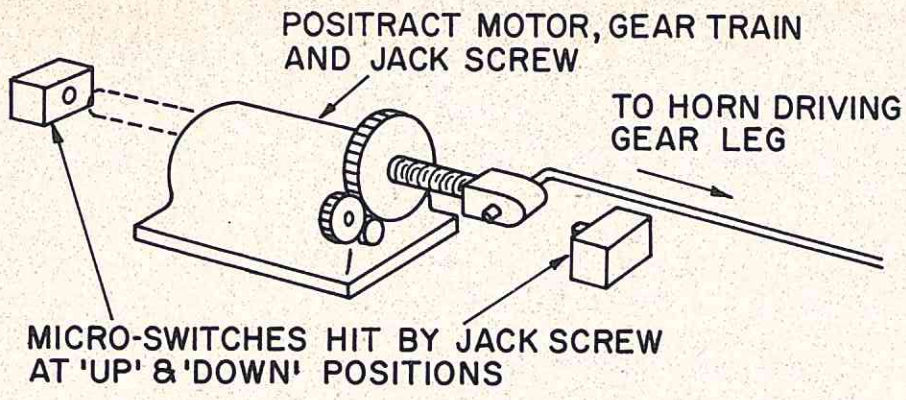


FIG. 2

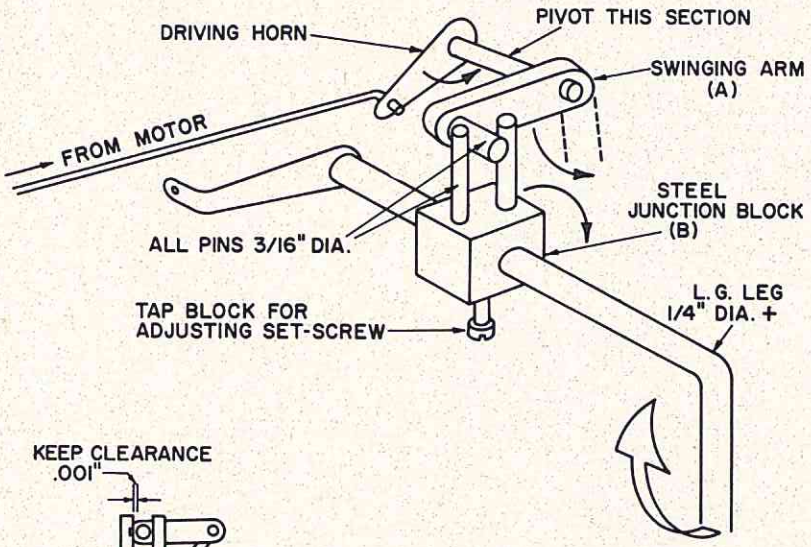
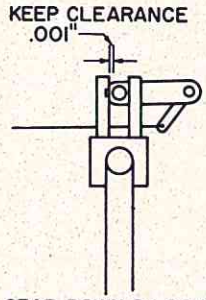
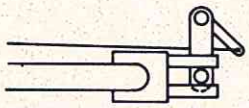


FIG. 3



GEAR DOWN & LOCKED

FIG. 3a



GEAR UP & LOCKED

FIG. 3b

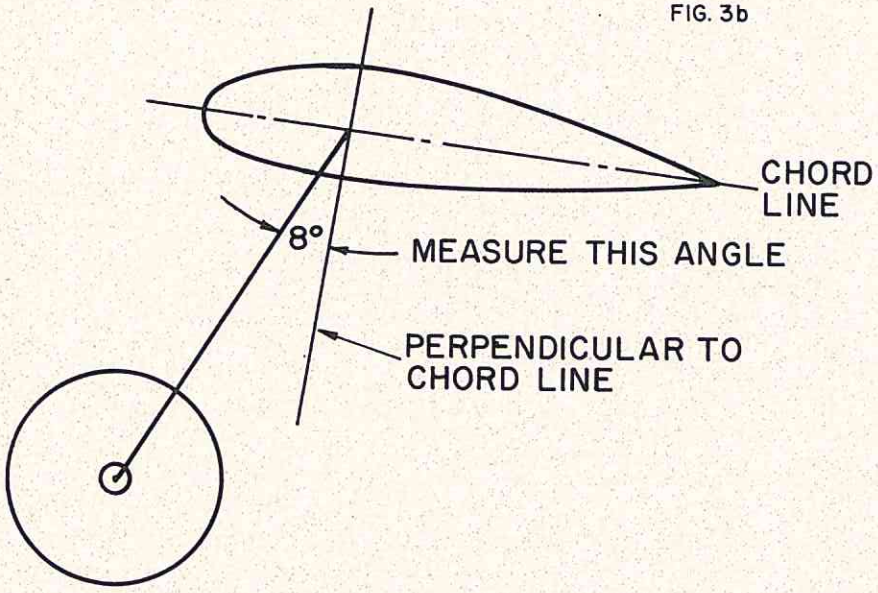


FIG. 4

but there is.

Clockwork motors, in my experience, are too weak unless you get a big one and then it is heavy.

Servos provide one big attraction . . . .simplicity. It would seem a desirable state of affairs to simply plug into the receiver our prime mover; no extra batteries, no limit switches, light weight, instant replaceability – all powerful "plusses". The only "minus" is cost. At $40.00, or $80.00 if we mean to use one servo on each leg, the system does not come economically!

Leastways, cost was the only minus that I could see for quite awhile. Since I was looking for a good system, and to hell with all other considerations, I stayed with it until forced to realise something that I should have known all along – the power is insufficient.

Using a perfectly balanced leg, the only remaining resistance to retraction and extension is the actual friction involved in the pivot. I figured that with good workmanship the friction would be minimal, and for a long time failed to realise why a servo couldn't provide an adequate margin of power.

It took the building of a **F.W. 190** to show the answer. (Incidentally, the entire reason for choosing a **190** was that it represents the most challenging situation of any sideways – retracting WW II airplane – I knew if I solved *this* one, the others would be easy).

The friction, even on a well-made setup, is not small. This is because the spring is constantly pulling the pivotted section of the leg against its bearings in a sideways direction. Even using one servo on each leg – the same setup which had worked *fairly* well on the **Dauntless** – the **190** gear failed to be reliable, as demonstrated so ignominiously at the last Nat's! After that Nat's I finally admitted to myself that servos, for all their attractions, had to be forgotten as a prime mover.

Even so, I would say that so long as the legs of your subject are short and the wheels small and light, like on a **SBD**, or a **Comanche** or **Texan**, you can probably get away with servos. But, use one on each leg!

Turning finally to electric motors as the prime mover, we find that here is the only lasting answer to the power

(continued on page 64)

THE RAPIER

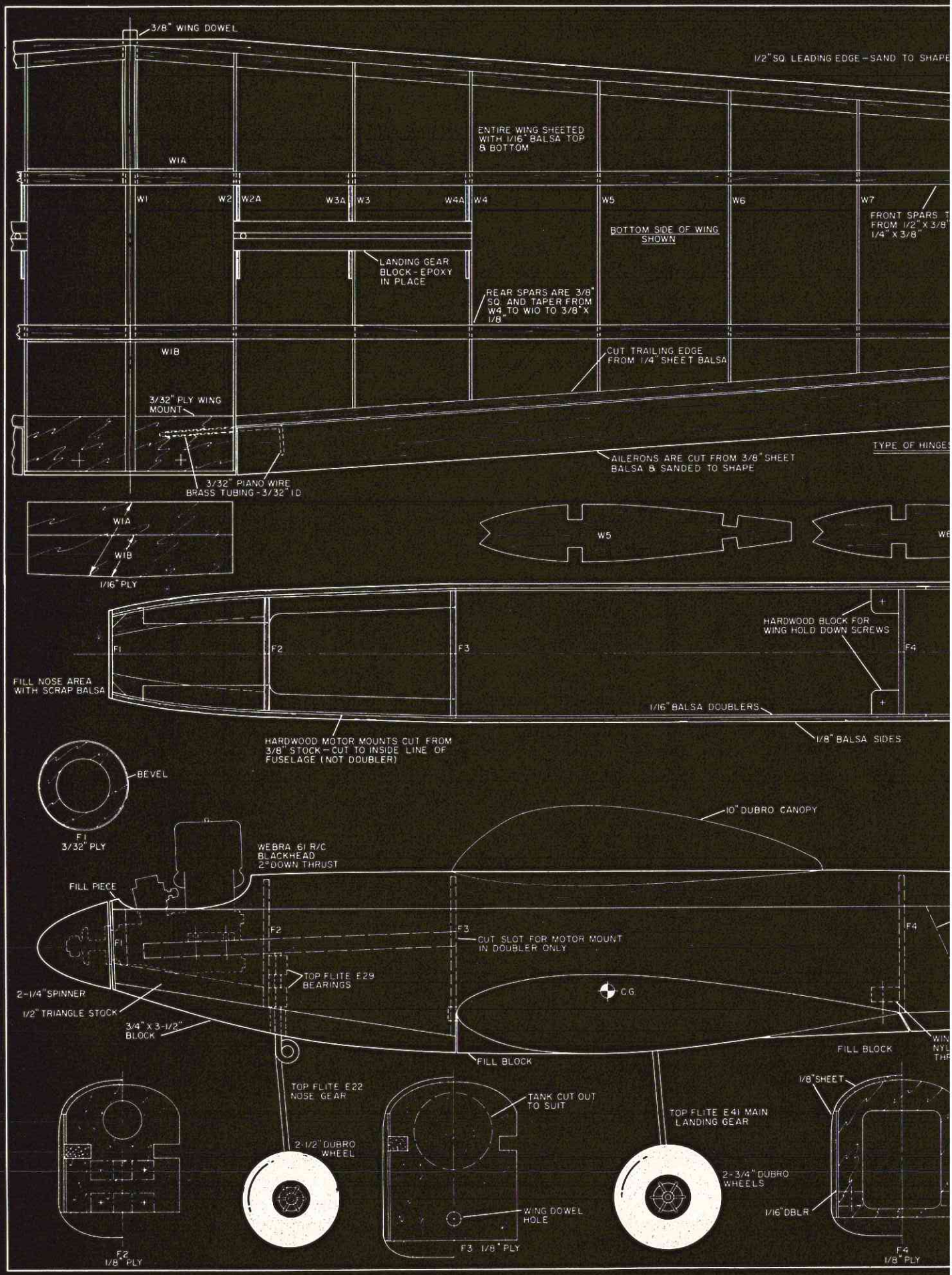
By DAN SANTICH

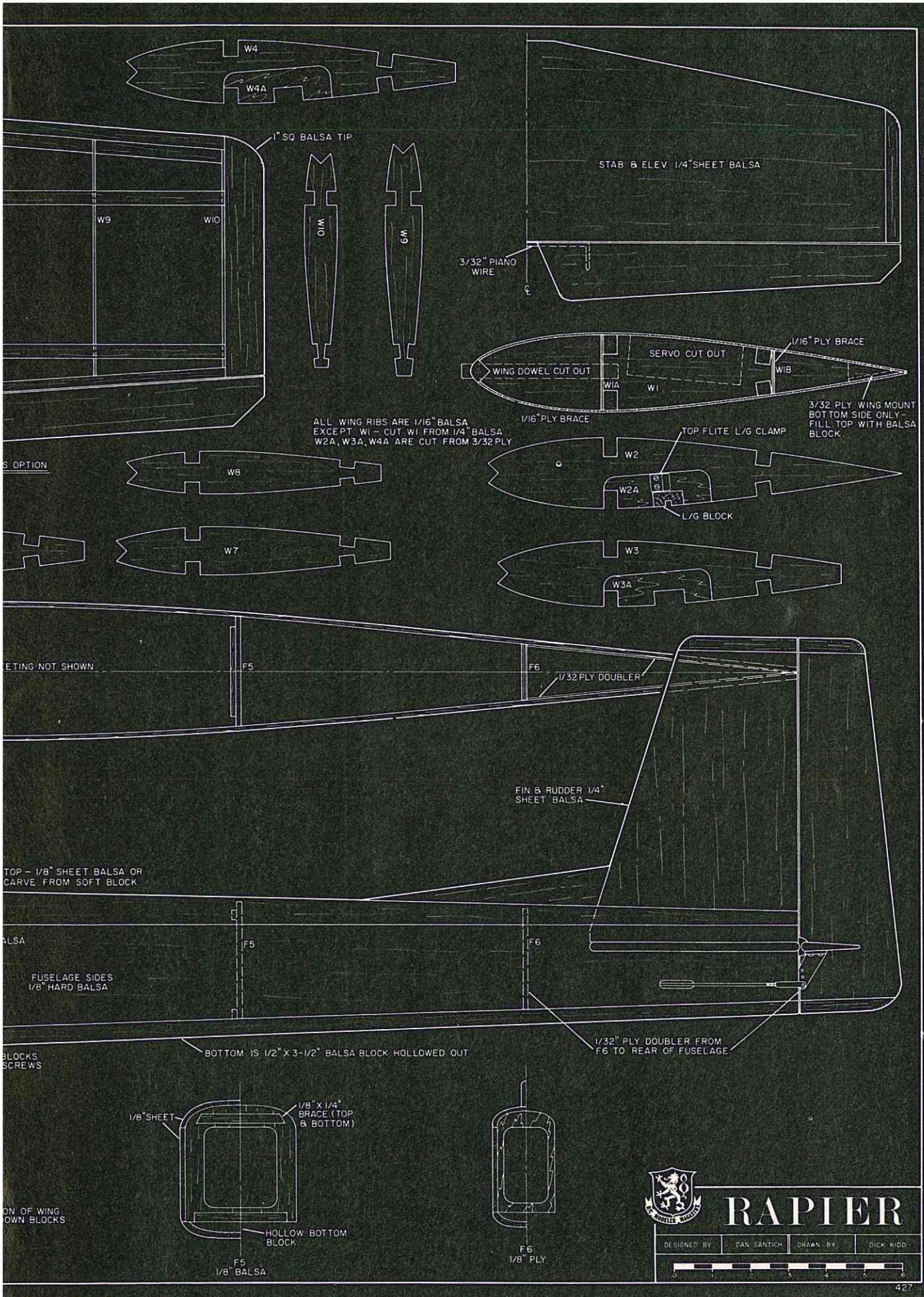
There is a song that goes "Oklahoma, where the wind comes sweeping down the plains". Rogers and Hamerstein didn't have to be modelers to make that observation since it is probably the windiest place in the US. (Check the Almanac!) Since I am a member of the USAF, I am subject to assignment anywhere in the world, and so Oklahoma City has been my 'home' for the past two years.

During these two years I finally came up with an airplane to suit the environment – the Rapier. It is a fast and yet docile little ship that flies as well in strong, gusty wind as it does in calm air. It is light at 5½ pounds and a 60 size engine really pulls it along nicely, especially in the Top Hat and vertical Square Eight where brute power is needed. The large vertical fin is very effective, which makes the double stall turn, reverse spin, and knife edge flight duck soup. The wing is a triple taper (LE, TE, and root) but is very easy to build, since it has no dihedral. I will go into this later.

The Rapier was completed only one day before the Witchita, Kansas Spring Rally so it was test flown, trimmed, and proven on its first flight, which was as official! We took second place! It literally flew right off the board! What I am trying to say is that it is truly a fine little ship that is easy to fly. You don't have to watch it every second and I would not hesitate to recommend it to a beginner, providing adequate initial flight supervision was rendered. I am not of the school that believes in

(continued on page 85)


3/8" WING DOWEL
1/2" SQ. LEADING EDGE - SAND TO SHAPE
ENTIRE WING SHEETED WITH 1/16" BALSA TOP & BOTTOM
W1A
W1
W2
W2A
W3A
W3
W4A
W4
W5
W6
W7
FRONT SPARS T
FROM 1/2" X 3/8"
1/4" X 3/8"
BOTTOM SIDE OF WING SHOWN
LANDING GEAR BLOCK - EPOXY IN PLACE
REAR SPARS ARE 3/8" SQ. AND TAPER FROM W4 TO W10 TO 3/8" X 1/8"
W1B
CUT TRAILING EDGE FROM 1/4" SHEET BALSA
3/32" PLY WING MOUNT
TYPE OF HINGE
AILERONS ARE CUT FROM 3/8" SHEET BALSA & SANDED TO SHAPE
3/32" PIANO WIRE BRASS TUBING - 3/32" ID
W1A
W1B
1/16" PLY
W5
W6
F1
F2
F3
F4
HARDWOOD BLOCK FOR WING HOLD DOWN SCREWS
FILL NOSE AREA WITH SCRAP BALSA
1/16" BALSA DOUBLERS
1/8" BALSA SIDES
HARDWOOD MOTOR MOUNTS CUT FROM 3/8" STOCK - CUT TO INSIDE LINE OF FUSELAGE (NOT DOUBLER)
BEVEL
F1
3/32" PLY
10" DUBRO CANOPY
WEBRA 61 R/C BLACKHEAD
2° DOWN THRUST
FILL PIECE
CUT SLOT FOR MOTOR MOUNT IN DOUBLER ONLY
TOP FLITE E29 BEARINGS
2-1/4" SPINNER
1/2" TRIANGLE STOCK
3/4" X 3-1/2" BLOCK
C.G.
FILL BLOCK
TOP FLITE E22 NOSE GEAR
2-1/2" DUBRO WHEEL
TANK CUT OUT TO SUIT
TOP FLITE E41 MAIN LANDING GEAR
2-3/4" DUBRO WHEELS
WING DOWEL HOLE
1/8" SHEET
1/16" DBLR
F2
1/8" PLY
F3 1/8" PLY
F4
1/8" PLY



FULL SIZE PLANS AVAILABLE – SEE PAGE 71

SCALE IN HAND

(continued from page 59)

problem. After some investigation of various motors, the best unit I found was the motor, gear train, and jack screw from a Wing Mfg. "Positract" retract-gear unit. This little motor is very light, quite inexpensive and has plenty of power to handle *any* landing gear leg; always assuming that it was balanced as previously described.

Since we are removing the motor housing from the Positract base frame, some other means of handling the limit switching must be found. I simply bought some miniature micro-switches from the same source, Wing Mfg., and installed these in the **190** wing, switched by the movement of the jack-screw, itself. This turned out to be a simple, light and highly reliable setup and is shown in Fig. 2. Note that I use a motor on each leg. Once bitten, twice shy! I've had enough of marginal-power setups. Now I have the legs on the **190** nearly a foot long and with a 4½" wheel, going up with power enough to squash a carelessly-placed finger.

3) Turning now to *locking systems*, let me first give the requirements: A means must be found of positively locking the legs in the down position. This lock must be strong enough to withstand any sudden and very heavy side load in either direction (toward the fuselage or toward the tip) without breaking. A scale job weighing up to 12 lbs. and landing at up to 25 mph puts quite a strain on the lock. The down-lock must be stronger than the wing itself: this way, any landing that the wing can take will not break the lock.

A lock for the retracted position is not essential but is highly desirable.

Lastly, the lock design must be such that no landing load, no matter how severe, can reach the prime mover. Otherwise, the prime mover will be damaged every time and will become the "weak link", nullifying the purpose of a strong lock.

After examining all of the commercial units we could find, including the Positract, the BK system, the Royal (Japanese M.K.) system and the K.D.H. unit, I formed the opinion that the K.D.H. lock was the best, in that it was the only one which had a large margin of strength. Before anyone gets the idea that I'm knocking the other units, let me remind them that the units in question are not intended for 8-12 lbs. hairy beasts, and for their *intended* job are quite adequate.

The K.D.H. unit's geometry and method of locking is not new (what is?). I first saw this idea on a control-line **B-17** published several years ago in *American Modeler*, as it was then. The diagramatic of this system is shown in Fig. 3. It is easy to make, or have made for you, requiring only a vertical drill.

The actual retraction angle required by the model can be accomodated by altering the position of the pivot of the swinging arm (A), in conjunction with the length of that arm. The suggested sizes in the diagram should give a unit stronger than virtually any wing. After the correct position for the block (B) on the leg is found, the set-screw used for adjustment may be removed and the whole setup soldered, using high-melting point (but not "silver") solder.

4. Leg Strength. The questionable strength of the usual 5/32" wire has been a problem in many models. The use of thicker wire for the legs is almost

vital on a "retractor" because we need the leg to go up in the same exact location each time. Legs which have to constantly be straightened are a nuisance. I would advise the use of at least ¼" wire for the gear legs. Don't laugh – my **190** now has 5/16" legs! Sure, it's heavy. But it's *reliable.* Naturally, we can't wind music wire of this size into a coil, so we just go without one. It isn't necessary anyway. Two immediate questions arise from this: a) "How do you bend it?" Answer – use a torch to heat it while bending, and it will go quite easily. Use minimum heat to not destroy the temper of the metal; b) "Where can you get it?" Answer – Sorry; I don't know. Would you believe my 5/16" came from *Australia?* It's true! I couldn't find a source of wire bigger than 3/16" in Chicago, so a correspondent sent me some from Wogga Wogga Land. I leave this to personal researches.

5. Most modelers are mystified by the geometry involved in the "rake forward when down – rake back when up" type of LG, so very common especially in WW II. The **Hawkers, Spitfire, P-51**, etc., etc., etc., have this setup. Actually, it's quite simple. The LG unit or *pivot line* must be mounted at a dual angle in the wing. Here's how to calculate what this angle must be: a) Measure angle of rake forward when LG is down, relative to vertical thru wing chord. Example shown is 8° (See Fig. 4). b) Measure angle of rake back when up, relative to span line. Example is 21° (Fig.5). c) Add 2 together and divide by 2. Example 8° + 21° = 29° divided by 2 = 14½°. d) The pivot line must now be mounted in the wing at 14½° incidence within the section (Fig. 6) and 14½° tow-in (Fig. 7). It will be found if the modeler mounts his pivot line at this dual angle, that the wheel will track *true forward* when down and lay *flat* in the wing when up.

This information is evidently not known by most scale fans as witnessed by the usual straight-down legs when retract-gears are fitted.

Let me round off this somewhat exhaustive discussion on retracting landing gear by saying that my hope in making this presentation has been to encourage further experimentation along this line. Even today, a Scale job with retracting gear that is **Scale** and **works** is a rarity. No Mustang, Spitfire, Zero, or Me 109 should be seen with gear down while it flits through loops and rolls!

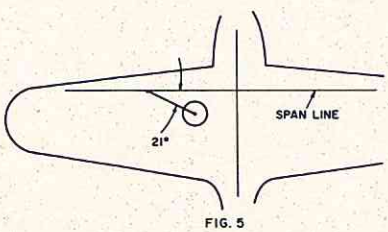


FIG. 5

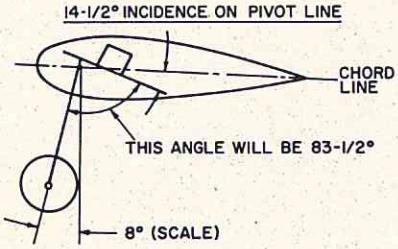


FIG. 6

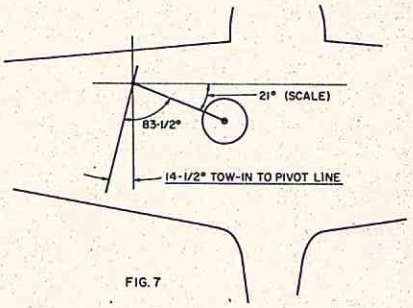


FIG. 7

WAGGER

(continued from page 47)

ships. Kids and dads will be resurrecting the plastic P-40 they got last Christmas and taking a few turns in the circle. Other guys will wander by and casually mention that they used to fly stunt but they got bored and dropped it. When they start casting interested looks at your R/C, the time will be ripe to invite them out to the R/C field next Sunday; from there on, if you don't snag some of those new members you want you're dropping the ball."

"Aw, Wagger," groaned Walt, "you're taking away some of the precious time for R/C!"

Wagger paused in the act of spreading a dab of Camembert between two Milk Bones, his usual low-cal lunch. "True, Walt, but consider: a little casting of the bread upon the waters could bring you new members, develop the skills of using flaps on ukies and light weight on indoor ships, review the skills of riding currents with hand launch gliders and in general relive the other thrills of model aviation through fresh eyes. How about suggesting "Fun Sunday" to your group, Walt, and give it a try?" ●

ENGINE CLINIC

(continued from page 12)

tributing to the drag of the aircraft. This is also the reason a tri-gear craft does not have as strong a tendency to turn left. In this case, only torque is tending to turn it.

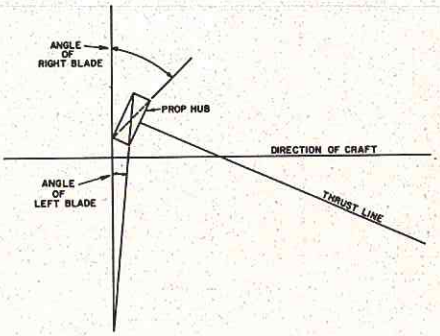
A good example of this is in slow flight. Try it the next time you fly a light plane. As the angle of attack increases more right rudder is required. If this was all torque, aileron would take care of it.

I don't remember which magazine it was off hand but one of the general aviation publications had a very thorough article on torque and "P" factor. Also, you will probably find that the older flight instructors preach torque while most of the younger ones expound on the "P" Factor.

As you say, "Gyroscopic precession, hmmm."

This column as well as the rest of this magazine is great. Keep up the good work. I've been with it since it started.

Yours truly,
Tony Vlasak ATR-3
Pacific MIssile Range
Pt. Mugu, California



I'd like to see that engineering handbook you recommended to Maj. Lemieux – the one that defines torque as "a simple twisting motion". (Just a bad choice of words – C.L.) All the ones on my shelf define it as the first moment about a given axis of the force distribution on a body, or words to that effect.

A good layman's description would be "twisting force" – when you twist a nut with a wrench the torque equals the force on the handle times the length of the wrench. At any rate, torque can CAUSE motion but it is not a motion by itself.

In an R/C engine, the torque is the "twisting force" the crankshaft puts on the prop, and you can bet your bippy it has

something to do with BMEP, displacement and RPM. Torque and RPM together define power output: multiply torque (in pound feet) by RPM, multiply by pi and divide by 16,500 and you get horsepower. That applies equally to R/C engines, electric motors, and engine designers twisting jar lids.

You and the Major, like most people who learned to fly before the 1960's, both have the wrong idea about why airplanes like to turn left on takeoff. There are four important influences caused by the presence of a rotating propeller:

TORQUE REACTION: This is the tendency of the airframe to rotate opposite to the prop rotation because, by Newton's Third Law, for every pound-foot of torque the engine puts on the prop, the prop puts one pound-foot of torque on the engine. It acts mainly in the roll axis, but causes a yawing effect on takeoff if the nose is up. This effect is insignificant on most airplanes, and can be almost zeroed out by a little washout in the right wing. The P-51, which has 161600-some horsepower turning a 400-lb prop, is a notable exception; a sudden power application in the landing configuration can put it on its back, and I've heard that on takeoff the left gear strut is compressed 3" more than the right one.

SPIRAL SLIPSTREAM: This is the effect caused by the rotating propwash striking the left side of the fin more than the right. Again, it's pretty small, and can be allowed for by offsetting the fin.

GYROSCOPIC PRECESSION: This is the tendency of a rotating mass (like a gyro) to tip in a direction perpendicular to an applied torque. It will cause the airplane to yaw left when the nose is lowered, as in raising the tail on takeoff. This is another small one, but again the P-51 is a big exception.

P—FACTOR: This is the big swinger. It's based on the vector combinations of relative wind velocity and instantaneous velocity of small prop blade elements, and is pretty hard to visualize. What it comes down to is that the descending prop blade strikes the air at a higher angle of attack than the ascending blade when the nose is high. This means the descending blade develops more thrust, and like a twin with more power on the right engine, the airplane wants to turn left. Likewise, in a nose-low attitude (like a high-speed dive) it will want to turn right. In a loop with a diving entry, the pilot has to hold increasing left rudder as the airspeed builds up in the dive, increasing right rudder up the front side, approximately neutral rudder on top, and increasing left down the back side. After leveling off, he relaxes the left rudder as the airspeed settles down. In general; right rudder goes with back pressure on the stick, and left rudder with forward pressure.

There are several smaller effects, mostly caused by the rigging adjustments that take care of the bigger ones, but there isn't much point in going into them; P-Factor is 90% of the problem by itself.

Now a flight instructor would be technically correct if he admonished a student to apply the proper corrections for "the various yaw effects arising from propeller rotation", but when the airplane is headed for the boondocks to the left of the runway, he needs something a little more brief. Therefore, all those weird little influences are lumped under the inaccurate — but short — name of TORQUE. (As in "Don't forget the torque, dummy, RIGHT RUDDER!")

As long as I'm on the soapbox, I might as well add a footnote to the airspeed vs. groundspeed debate The "airspeed" argument is 100% correct as far as it goes. There is no way that a steady wind can be detected from an airplane except by observing the ground, and in a turn with constant power and bank angle the airspeed will remain perfectly constant (except for a slight

decrease in speed due to the increased lift required in the banked attitude; this decrease isn't so slight with the super-steep turns we make in R/C, but it doesn't depend on wind). HOWEVER — steady winds just don't exist near the ground, since it exerts a frictional effect on the wind. It's common, for instance, to have a 5-mph wind at 50 feet altitude and 100-mph at 100 feet. This means it would help a Goodyear to fly high going downwind and low going upwind; the wind would add 10-mph at 100 feet. This means it would subtract 5-mph the other way. Gusts are important too; a heavy airplane will tend to "plow" through turbulence at a constant groundspeed, while a light one (compared to its size, that is) will tend to hold a more constant airspeed. An airplane with high yaw stability will tend to "weathercock" into a gust; this gives rise to the common belief that a big-tailed sailplane will "point into the wind better".

Yours truly,
Ralph Jones
Certified Flight Instructor
Huntington Beach, California

I want to thank you for the many fine articles presented in your column each month concerning all the many available power plants and their preservation. Usually I turn to your column first, to see what is new. We modelers have sorely needed the knowledge of a man such as yourself. How about starting a series of articles, a little each month, purely on the complete overhaul of a popularly used engine.

Now I want to say this about Major Lemieux's article which you printed. I do not want to be critical of either you or the Major. Gyroscopic effect is very pronounced in high performance aircraft, especially tail draggers in the F-51 category. I do not disagree on the effects of torque on the performance of any aircraft, but gyroscopic precession causes the same effect on performance, as does torque.

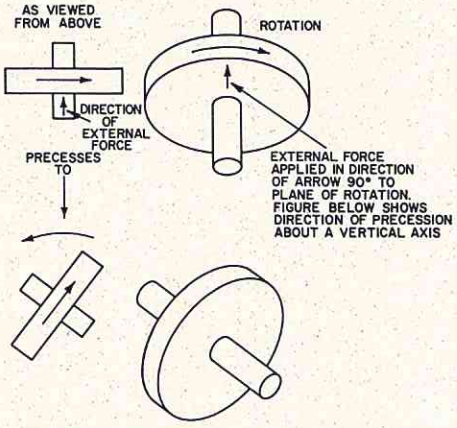
A word about the properties of a gyroscope. The gyroscope is essentially a wheel revolving so rapidly about its axis that the momentum of rotation restrains the gyroscope from changing direction about its axis. The property of a gyro to resist any force tending to displace it from its plane of rotation is called gyroscopic inertia or stability. This tendency is proportioned to the speed of rotation, or in other words, stability increases with an increase in speed. As a result, the gyro establishes a fixed reference plane of rotation. When an external force is applied to a spinning gyro, the rotor axis is NOT displaced in line with the applied force. It is displaced about an axis that is at a point 90 degrees to the direction of gyro rotation from the axis about which the external force is applied. This property is precession. See enclosed photo copy of illustration.

Now assume that we have a high powered tail dragger lined up on the runway, with its big 500-pound gyro (commonly called a propeller) spinning up front at slanted angle to its take-off roll. As power is applied, torque causes a turn to the left. Now apply rudder correction to maintain center line, force tail off ground, and watch for more left turn because we changed prop plane of rotation. We have broken ground friction with the tail wheel — true, but by the same token speed has increased to a point where rudder is more effective, so we should be able to release some rudder pressure. But no, we have to pump in more rudder, and there is gyroscopic precession adding to the effect of torque.

Mr. Lee, I had intended to close this letter with the last paragraph, but during the past week, I attended a professional pilots instrument flight seminar at the University of Tennessee. This seminar was sponsored by the University and the Tennessee State

Aeronautics Commission, but was conducted by Federal Aviation Agency instructors, out of the Academy at Oklahoma City. One of the topics of discussion was torque, gyroscopic effect and "P" factor, all of which causes an aircraft to turn left during take-off or during maneuvers which causes high increases in angle of attack. I have not expanded on "P" factor for two reasons. Number one I do not know enough about it and number two this letter is getting too long. Shortly, I will receive literature from the F.A.A. at Oklahoma City relating to all of the above and this will be forwarded to you.

Yours very truly,
Allen E. Bailey
Tri-City Aeromodlers
Kingsport, Tennessee



SUNDAY FLIER

(continued from page 8)

Genial Bill Cannon explains kit, semi-kit, and assembled equipment philosophy.

Logictrol's Bob Elliott logically explains to Cliff Rausin of Technisales why he thinks E-K Products are the best.

(continued on page 74)

BONANZA

Millions of television viewers will recognize this meadow as the familiar opening shot where the famous Cartwright family are introduced on the popular program series 'Bonanza'.

Actually it is a 17 acre meadow on the edge of Lake Tahoe owned by Steve Bourne. Steve is a very serious RC flyer who, in the past, was limited to temporary flying sites around Lake Tahoe. So with motor grader in hand he proceeded to build an RC airport out of the famous meadow used in the Bonanza series.

The strip is 300 feet long and 40 feet wide with the prevailing breeze coming off the lake. Take-offs are out over the water, for any engine failure, or loss of lift in the thin air (the elevation of the lake is 3,500 feet), has proven to be disasterous.

The most interesting aspect of the hobby to Steve is Winter flying off of the strip. He has tried skis and big tires for lifting off the frozen white stuff, but the most successful is a set of Gee-Bee floats normally used for RC seaplane applications. The floats are large enough to support his Veco .61 powered 'Tango' biplane. When the engine is turned on, the airplane just whistles over the snow, making for a smooth take-off in the thin air.

Glider flying is also a great sport from the meadow and Steve is currently flying a Phillips Foam-Glide with an .09 on a power pod. In the thin air it takes muscle to get it up and out over the lake in order to soar.

Al Kinderick provided us with the photographs taken on the property of Steve and Norma Bourne who live on the South end of Lake Tahoe – an out of the way spot that provides a great degree of privacy – despite the fact that it has been "visited" by the several million people who faithfully follow the activities of Ben, Hoss, and Joe Cartwright. ●

FINISHING THE PYLON RACER WITH HOBBYPOXY ENAMEL

By BUD PHILLIPS

Reprinted From The Pioneer R/C Club 'Modulator'

There are three basic factors that aid the builder in gathering more appearance points: **1) Craftsmanship 2) Design and trim 3) The Paint job.** The NMPRA encourages modelers **NOT** to trim their models like the real ones. Each model can be painted and trimmed to suit the modelers preference. At contests, many models are seen that are well finished with only a simple one-color paint job. Perhaps a well-built and well-trimmed plane would add to the owners pride even if the additional points gathered would be hardly evident. In this article, an attempt is made to cover the finishing of the plane, although the paint job will never be any better than the basic building job.

MATERIALS: Starcast resin, Hobypoxy (colored and White), Auto primer and paste, lacquer thinner, tac-rag, 320 garnet paper, 400 and 600 wet-or-dry paper, ½ and ¾ inch width masking tape, and degreaser.

EQUIPMENT: Compressor, diaphram or piston type capable of producing 2½ to 3 cubic ft. per minute at 30 to 40 lbs. pressure. Spray gun, DeVilbiss model EGA-502 with 390F nozzle.

WOOD PREPARATION: After sanding, coat the balsa with two coats of "Starcast" coating resin. Allow the first coat to dry well before the application of the second coat. Be sure to stir the wax that has settled and shake the can to mix well. Sand the resin with the garnet paper, avoid sanding through the resin.

FIBERGLASS PREPARATION: Fiber-glass needs to be roughened with 400 wet-or-dry prior to painting.

PRIMING: Mask off the windshield and spray on a coat of auto body grey primer. This will reveal all your "boo boos". Fill the holes with auto primer paste over the primer coat. Sand the entire plane free of any primer with the 400 and 600 wet-or-dry paper. Repeat this process until all the holes are filled with either primer or paste. CAUTION – do not leave any unnecessary primer on the plane as it is very heavy. The paint will stick without the primer base. If by accident, you have sanded through the primer and resin (very obvious at this point) it can be corrected.

CLEANING THE MODEL: Using your compressor, blow air into all open parts of your plane. All dust needs to be removed now so that it won't be imbedded in your paint later. Wipe your plane with a degreaser solution and allow it to hang and dry. Just before painting, the final cleaning is done with a "tack" rag. Don't underestimate the value of this 35c item.

MIXING THE HOBBYPOXY PAINT: Mix the two parts and allow to settle for 1 hour prior to thinning. This can be rushed by placing the container (lid off) in boiling water for several minutes. THIN the mixture to suit your gun. I use an equal amount of thinner to my mixed Hobbypoxy because my gun shoots a finely atomized spray. Experiment with the combination until your gun "whistles" when spraying. Avoid "orange peel" by adding thinner.

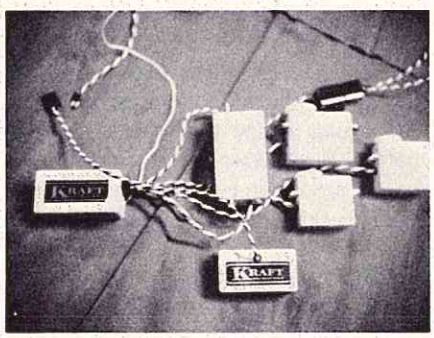
SPRAYING: If you spray outside, pick the best time of day, to avoid wind, dust, and excessive moisture. You may find this hard to believe, but I spray mostly after dark with light coming through the glass doors. When you get used to the sound of your gun, good light isn't always necessary. Of course, it is preferable to have a spray booth and good lighting.

"Fog" your first coat and hang each part to dry where the smallest surface is exposed to catching dust. All drying should occur in the room where the least dust exists. The second coat can be applied almost immediately after the previous part has been hung to dry. Continue to apply the necessary coats until a nice "rich" color appears. Allow each coat to dry to a "tacky" touch before the next coat is applied. Best colors are obtained by always having a white base before applying the color.

MASKING: I like to design and mask my planes for several colors. Designs should be well thought-out prior to the masking operation. Use good clean masking tape. Run your fingernail along the edge exposed to paint to make it seal. Use a light first coat and let dry. A good building job is worth a good paint job with good equipment. ●

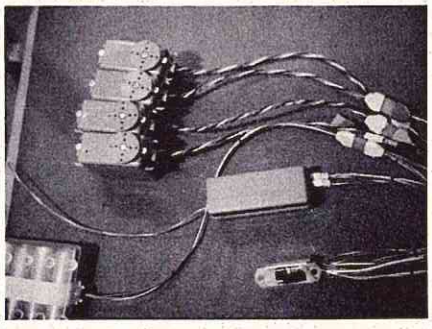
Jay Brandon of Dumas has his ear bent by Bill Hannah of Heathkit, who explains that the 3600 reading on the Thumb Tak comes from the 60 cycle (3600 per min.) bulbs in the ceiling. Useful little gimmick for calibrating.

Ernie Allenbaugh and Marty Barry of Kraft Systems tended to the the customers. Charlie Brown (Cliff's Charlie, fella!) and Chuck Hayes can be seen in back, taking time to watch a bit of the Super Bowl action on TV.



Kraft's new receiver unit, with integral harness plug, is shown with a KPS-9, a KPS-10, and two of the new, tiny KPS-12 servos, with a 225 ma. pack down at bottom of the picture. And those KPS-12 servos are the smallest in the industry! I put one in a tray designed for the Orbit and Micro Avionics little jobs, and the Kraft servo rattled around in the tray. Not too much, true – but enough to prove the fact that they are smaller. And that's progress.

Hans Weiss tries out the sticks on Larson Electronics transmitter, while Frank Kagele shows the Larson innovation of having the harness all connected in the switch.

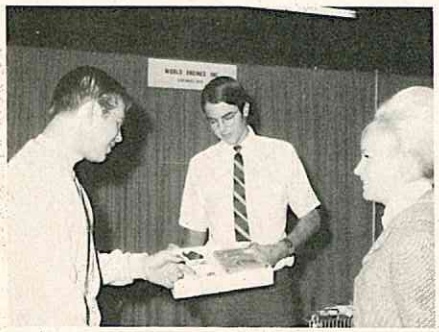


Closeup of Larson's lightweight receiver – five channels at 7/8 of an ounce! With the lightweight servos and battery pack, Larson's flying weight for four control operation is **under** nine ounces. Larson is a new name, but the company is manned by oldtimers, and they'll make some waves in the industry with their innovative approach.

Bill Northrop, center, newly crowned "native Californian," gets confused while trying to compare the merits of Micro Avionics single stick and two stick orange colored transmitters to Edie and Ray Downs. Bob Dunham, left, and Al Strickland, right, keep watch on the proceedings now that it's all in the family. Datatron family, that is.

Chuck Moses, Bob Dunham and "Big John" Elliot stand guard over vivacious Stella Jaime, who holds Orbit's new single stick transmitter. And look at that unbelievable model overhead, which is actually flown with Orbit's equipment.

One of the equipment highlights for the West Coast modelers was a look at the Pro-Line Proportional system, rapidly gaining in popularity among the nation's competition fliers.

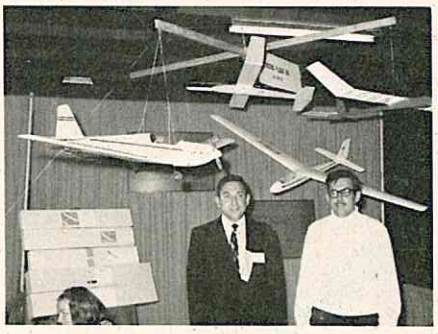


Bob Strickland shows World Engines' new three channel rig to Bob and Carol Foster. Bob Foster, for those of you who don't follow boats, just happens to be the world's fastest boat driver."

To wind up the section on radio equipment, this interesting observation is made. No manufacturer displayed any galloping ghost equipment. At least I didn't see any. World Engines showed the only single channel equipment, other than Testor's Skyhawk, and World's was digital propo – but for the same price as the Mule. It looks like the state of the art has passed up the tinkerers – at least as far as the manufacturers are concerned.

AIRPLANE KITS'

I've divided this section into two groups – plastic, or composition type construction models, and the old standby balsa types. Balsa first, alphabetically.



Roland and Robert Boucher of Astro Flight proudly displayed their line, including the Malibu, a proven winner, and the new Fournier RF-4 powered glider like the one Miro Slovak flew across the Atlantic. Astro Flight

has a good line of gliders and small power planes.

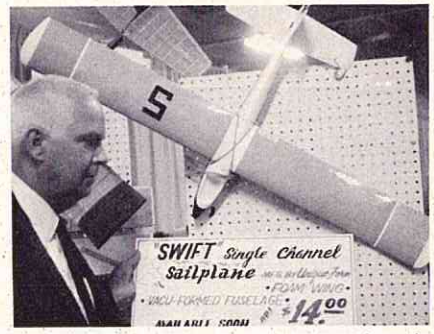
The Dumas line of planes and boats keeps pace with the wood construction techniques. Byron and Jay Brandon pointed out the "Fly Any-Way" benefits of one model with interchangeable power and soaring wings.

Bryan Smith reloads the display movie camera while Mark extols the virtues of the Marks "Windward".

Big Frank Garcher of Midwest Models was fighting a miserable cold, but that didn't stop him from demonstrating the features of Midwest's "Flea Fli plus 10".

Jack Stafford continues to put out his fabulously precise balsa kits. Dave Lane smiles happily at my expressed admiration for their newest racer. "Ole Tiger" due out in about 3 months from the time this appears in print.

Mike Schlesinger touts the R/C version of Top Flite's Nobler, which gave a great exhibition of flying during the show. As usual, Sid Axelrod is doing the ironing – but with their own new iron, out soon, for MonoKote. It is **not** true that Sid takes in ironing between shows just to keep proficient. It really is easy to iron MonoKote. Try it.



Plastic models keep increasing in numbers – especially in the flying category. Donn Kaylor of Cal Hobbies will put out the "Swift" sailplane. It is ready to fly, and can handle any of the new small propo rigs if you want to fly rudder and elevator.

Sal Taibi is eminently pleased with Competition Models unusual design structure of corrugated sheet with wood framing. Martin Samstag, of Laguna Hills, looks very impressed by Sal's sales pitch.

Dewey Broberg with his "Sea Bird" ARF, designed for amphibian service with conventional landing gear. If it

flies as good as it looks, it should be a real pleaser. Bill O'Brien will test fly it for RCM.

Carl Goldberg, the old master, is entering the plastic ARF field with an enlarged version of his foam model, the Ranger. Here he is with the "Super Ranger," a five foot design with foam wings and vacuum formed fuselage. Still under development, it looks like a formidable competitor in this fast growing field.

Happy Jim McManus, of J & M Custom Glass Models, displayed a line of fiberglass fuselages. The SE-5, up above, uses his fuselage and foam wings, and shows what great progress is being made in this field.

Jerry Nelson, proprietor of Nelson Model Products, with a great line of imported kits augmenting his own KA-6 record holding glider.

Paul Sherlock, of Sherlock Aircraft Models, is one of the most exciting

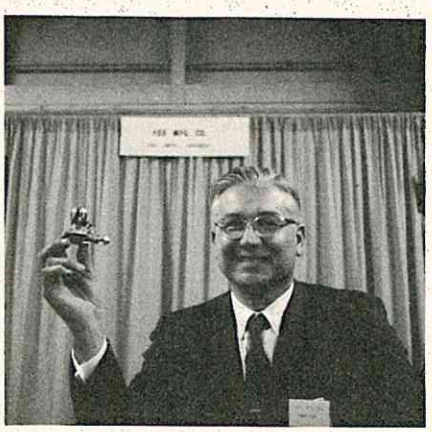
newcomers to hit R/C modeling in years. First, with his fantastic Boeing 747, then with his kit version of the LearJet, he has introduced some of the most advanced designs to the R/C fraternity that have been presented so far. Here you see Bobby DeMaderios, Paul, Jo Ann Kimbull, and Ron De Maderios happily displaying the LearJet after Paul's great flying show. Ron is the genius behind the production methods used in forming the LearJet components.

Sid Krane and Stew Shapero of Testor's are very happy with the performance – and the public acceptance – of their new .049 engine which they now have installed in the Skyhawk, as well as their control line models. Testor's does a first class job of merchandising.

Sam Crawford talks with Tom Protheroe of Vortex Model Engineering, while Roger Grigsby, center, looks skeptical of the whole bit. Tom showed his new improved Santa Barbara One Design – beautiful! Also, that sailplane fuselage in the background is for a 14' design that Tom has just about finished, that should be a winner.

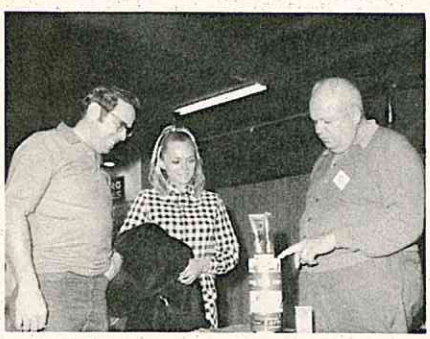
Joe Stanton gets a sales pitch from Dale Willoughby on the pleasures of soaring, and the advantages of his fiberglass fuselage, for the Elfe 10' scale model.

ENGINES AND ACCESSORIES



Duke Fox showed his entire engine line, so I picked the new .15 for him to display. He's got a carburetor design with variable intakes that gives his motors excellent flexibility from full power to idle.

Steve Mallory, an ardent R/C modeler from Whittier, looks over the .049 auxiliary motor pod for gliders put out by Dick Rehling of D & R Products in Laguna Niguel. If you don't have a winch, and the land is flat, then an auxiliary motor will get you up where the rising currents are, says Dick.



Cliff Weirick and the ubiquitous and gorgeous Charlie Brown of medeling are amused by Bev Smith's "priceless" Hobbypoxy warmer. Put a 75 watt bulb (or is it 60 watt?) in a coffee can, stick a

one gallon fruit cocktail can over it, upside down, top removed and bottom perforated, held about three inches up by a screw in the side of the coffee can, and the Hobbypoxy will be warmed to exactly 120° for mixing and application. Write Bev for details. Incidentally, Hobbypoxy's new 5 minute dispenser packet is great. Also, I tried the five minute stuff against a well-known competitor. Put them both, after mixing, on a piece of paper, let them harden overnight, and the next day, bent the samples. The Hobbypoxy was still flexible, even though cured, while the other product was brittle and cracked. Sold me.

Larry and Granger Williams plugged their products – especially their new larger pilot and the detailed machine gun they've produced for scale.

Roger Norsikian with Norco Marinecraft Models' new 46½" "Balboa" Express Cruiser. Boy, would I love one of those – especially if it was 46½ feet. Dreamer!

Don Patton of Lee's Hobby hears all about Octura Models new 'Wildfire' monohull speedster for .40 to .60 power. Steve Muck is the pitchman.

R/C race cars were represented by George Siposs of R.O.A.R. – Radio Operated Auto Racing.

One of the most well-known names in modeling circles, X-Acto, Inc., displays their versatile and complete line of tools for the modeling craftsman.

Cox Mfg. Co. displayed their line of engines, ready-to-fly ukies, and the dune buggy, which has become popular with RC'ers since RCM's article on converting it to R/C use.

And that was MATS, 1970. Except for a couple of untimely occurrences. John Tatone had to leave due to a death in the family, for which we extend our condolences, and the MRC-Enya people had to cancel their appearance due to illness. We missed them both.

Jim Kelley, Don Barton, and the Garden Grove R/C Club are to be congratulated on another good show, and I, for one, am looking forward to the 1971 edition already! ●

(continued from page 7)

busy one for me that several months may elapse between flying sessions. Boy, that first flight is kinda' tough on the nervous system until all of those keen reflexes are all sorted out again. Many times it has been "puckering time". What the heck is "puckering time"? Simple. Do you remember the feeling that you got the last time you got into trouble, in the AIR, Don? Do you remember how your toes kinda' dug into the ground, your leg muscles tensed up, and your fanny clenched real tight? Thats "puckering time!" A couple of months ago I watched a friend of mine flying in a fun fly contest. He is rather slight of build, and was wearing tight pants. Each time he did a difficult maneuver, you could tell it simply by standing ten feet behind him and watching a strategic area of his anatomy!

But back to the subject. If you take a brand new bird out to fly that first day after a long layoff you may dork it into the ground just because your reflexes are not up enough to get you out of the troubles that can be brought about by a new aircraft.

OK, so you start off this years flying with the same old dog-eared bird that you ended up the season with last year. Great, you have the breaks going for you, but what about that good old set of radio equipment that has been laying around the past few months? Did you leave it in that fuel soaked airframe, and just let it sit on a rack in the garage all winter, suffering temperatures of 10, maybe twenty degrees below zero without a thought other than, "Gee, I wish that I could get out to fly?" That ultra-cold weather may not have bothered the aircraft much, other than to age the skin and glue joints a good bit, and quite probably didn't do any damage to the radio. But how about the batteries, both airborne and transmitter? How about that engine? Any oil in it, or just dust and condensation for the past six months? Of course, its a little late in April to think about all of the things that should have been done in October, but if you didn't do them in October, perhaps now in April you can take a little time to check things out before that first beautiful flying day.

Back to October – if you were planing to store your aircraft for the winter months, it would have been a good idea to find a storage spot that didn't have too wide a temperature latitude. If you can find a semi-warm spot in the house

or basement for storage, then sneak in the toys when your wife isn't looking. Keeping your aircraft in a reasonable temperature range will prolong their lifetime quite a bit.

The radio and batteries should be removed from the aircraft during the Winter and the airframe should be thoroughly scrubbed to remove the oil and dirt prior to storage. A very good cleaner, by the way, can be made by using about one inch of liquid dishwashing detergent in a spray bottle. To this add about two inches of household Ammonia. Fill up the bottle with warm water, shake up the mixture, and then spray it on for cleaning. This will cut through most castor build-up and will clean up a model very quickly.

You can leave that engine bolted into the aircraft if you want, but put a few drops of 3-in-One oil into the exhaust and intake ports and turn the shaft over a few times to distribute the oil. Wrap a clean rag around the engine to prevent dust from getting into the exhaust or intake. Do NOT seal up the engine with masking tape, or plugs. This will keep the engine from breathing and will cause many condensation problems in the spring. For that matter, if you have stored your fuel over the winter it, too, should be stored in a place with moderate temperature cycling. Condensation can happen within the fuel and a great deal of moisture can creep in. If you have a partially consumed gallon of fuel at the end of the Summer flying session, It might be smarter to trade it off to a friend that is going to fly one more time than to try and store it for the Winter. If you have a full, unopened gallon then save it for the Spring, but before you use it be sure and shake it up completely, then filter it through a cheese cloth strainer before using. Remember what the friendly florist-engine man, C. Lee has been saying about filtering your fuel.

The actual storage of your radio equipment should be done in the house. Be sure it is stored in a place where it is not subjected to great heat, or to great cold but, rather, in an area that has a reasonable temperature all of the time. After all, the period of the year during which it gets the most use, the temperature probably doesn't fluctuate more than thirty degrees. But during Winter storage, this temperature can vary, in parts of the country from ten above to ninety above. This is very common here in Texas. Of course, the radio can "take it", since the components have a wide temperature tolerance range, but why subject them to it? My gosh, the family

car sure has a hard time in the Winter. How many of you lost your car battery during this past cold season? If you're not going to use your radio, wrap the receiver, servos, and transmitter in a soft cloth and put them into a safe place. Store the receiver battery with the transmitter battery. Then, about once a month take the transmitter and receiver battery out and charge them for twelve hours. This will prevent the batteries from going dead from sitting on the shelf. Better yet, you can hook everything up and work all of the controls for about half an hour once each month. Charge the batteries for twelve hours, work all of the controls for half an hour (It's okay if you make some flying noises in your throat while you're working the controls as long as your wife doesn't hear you) and then charge the set for another twelve hours and put it back to rest for another month. This isn't a set schedule that must be followed, but if you want to preserve your battery life, it sure will help. (By the way, have you ever heard your wife making "sewing" noises in her throat when she was planning a new dress? Of course not, this is a pasttime restricted to young boys, and older boys, dreaming of their fun and games!)

If you haven't done all, or some of the things that I have outlined above, and Spring has come and you're thinking about getting out the old gear and going to fly, then take the time to check out a few things first.

First, let's consider that aircraft thats been sitting out in the garage all Winter, fuel soaked and molding. Brew up a little cleaner, as mentioned earlier, and clean it all up. Check out all of the glue joints. Is the horizontal stab still stuck on the fuselage? How about the vertical stab? Grab 'em and see if they will come off. Add a bit of epoxy here and there if in doubt. How about that firewall? Will the engine still stay in the aircraft? If not, again a liberal dose of epoxy is in order. How about the hinges on the rudder, elevator and ailerons? Do they still work, or will they rip off in that first dive and resulting pull out. Check 'em. Next, take a look at the engine. If you are "in the know" about engines, a little disassembly and a quick clean-up won't hurt. If you're all thumbs when it comes to engines, then unbolt it from your aircraft, remove the prop and the glo plug and immerse it in a coffeecan of gasoline. Turn over the shaft a few times and swish it back and forth in the gas to wash out any crud that may have settled in it over the Winter months. Remove it from the gas

bath and shake it dry. Put a few drops of 3-in-One oil in the exhaust and intake, and turn over the shaft to spread the oil. If nothing binds, then put in a new glo plug, put the prop back on, and return it to the aircraft.

Your radio should be charged for twenty four hours after a long period of storage. Then turn everything on and work all of the controls for at least an hour. If you are handy with a volt meter, take a reading of both the transmitter and receiver battery packs at the end of this hours work. If the voltage is still up to snuff, then recharge for another twenty four hours, then go out to fly. If the batteries don't check out, or if they look as if they have fallen off then further investigation is needed. Remember, Nicad batteries carry 1.2 volts fully charged. If they fall below 1.1 volts at the end of an hours operation, then you may have one or more dead cells. If you have a four cell pack, and almost all of the modern sets do have, the reading should be 4.8 volts fully charged, and not less than 4.4 volts after an hours work. If your pack reads 4 volts or less, then you have troubles! Either send the pack to the manufacturer of your radio equipment, or open the pack and find the bad cell yourself. This is easy to do, and you can get replacement cells almost anywhere now. If three cells in your pack are good, then remove the bad cell, recharge the three remaining cells, charge up the cell, and solder it into the pack. Cycle the pack at least twice with the new cell to be sure that everything is working satisfactorily. Don't overlook the transmitter batteries as these can fail as well.

Before you make your first flight, in fact, before you drive out to the flying field for that first flight, range check your gear. Go by the manufacturers directions for range checking and take that little extra time to be sure that you have the safety margin on your side that first beautiful flying day.

By next month I hope to be able to bring to you a column on teaching your youngsters to fly with a new Buddy Box system. I've had one added to my EK Log III set, and am designing a simple rugged aircraft to use in teaching my ten-year-old son to fly. It might also be simple enough for Dewey! The Buddy Box by EK will be featured as well as the small aircraft on which to train. For want of a better name, it carries the title of 'The Brat', which isn't bad for a bouncy fun type aircraft for .10 to .19 power.

Good luck, and Good flying. ●

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progressive learning via galloping ghost, reeds, propo, in that order; and high wing, mid wing, low wing transitional training. The individual, himself, will determine this for himself, however. I believe you will save quite a bit of time and money if you go all the way right off. I have seen student pilots who had never touched a transmitter solo a Quik-Fli after only one lesson. If you have the desire and the money, go all the way. This hobby can be one of the most rewarding experiences of your life.

CONSTRUCTION

Fuselage:

(1) Cut sides from 1/8" sheet.
(2) Cut doublers from 1/16" sheet.
(3) Cut slot in doubler for motor mount.
(4) Epoxy doublers to fuselage sides.
(5) Epoxy motor mounts in doubler slot.
(6) With fuselage sides pinned vertical, epoxy bulkheads F3 and F4 in place.
(7) Attach nose gear bearings to F2 and epoxy F2 in place, making sure of equal bends at nose.
(8) Epoxy F1 on nose and add fill piece.
(9) F5 and F6 can now be glued in. Be careful of alignment.
(10) Drill motor mounts to suit engine and add blind nuts.
(11) Cut 1/8" top sheet to rough shape. Soak in water and form over shape of fuselage with rubber bands until dry. When dry, trim to fit and glue in place. Cut slot in rear for vertical fin.
(12) Cut lower nose block to shape. Drill hole for nose gear, align and epoxy in place.
(13) Cut horizontal and vertical stabs from light ¼ stock, shape, and glue in place. Add dorsal fin.
(14) Rough shape and hollow out ½" x 3-½" soft balsa and glue to bottom of fuselage.

Wing:

The wing is constructed upside down on a flat surface, since there is no dihedral. The bottom does taper up toward the tips which gives a dihedral effect.

(1) Cut all ribs from 1/16" stock.
(2) Cut out and glue W2A, W3A, and W4A plywood landing gear braces to ribs.
(3) Attach metal landing gear braces to W2A (left and right side).
(4) Pin 1/2 x 3/8" top spar to table. The wing is being built upside down, remember. (The left and right wing panels are constructed at the same time).
(5) Glue and pin all ribs along top spar, being careful of alignment.
(6) Glue bottom spar to ribs.
(7) Glue leading edge and trailing edge stock in place. Trim.
(8) Epoxy landing gear block in place.
(9) Glue rear spar in place.
(10) Remove wing from table and glue top rear spar in place.
(11) Glue 3/32" plywood wing mounts in place.
(12) Glue 3/8" wing hold dowel in place.
(13) Sheet wing with 1/16" balsa.
(14) Glue 1" x 1" wing tips on and carve to suit.

Finish:

I like the Hobby Poxy-Easy-Does It Method, however there are no really difficult curves so Super MonoKote would do fine also.

Flying:

Check your controls for proper trim and make doubly sure your control movement corresponds to what you give it with the transmitter. On the take off roll, don't try to "Horse" it off. This can be disastrous! Just keep it straight and hold a slight amount of up elevator and it will lift off quite smoothly. One of the most confusing things for a student is orienting himself in relation to his ship, particularly when it is coming at you. Some say "turn your back and look over you shoulder", others say "push the stick in the direction of the turn", and yet others believe you should imagine yourself in the cockpit, etc. This is simply something you will have to learn by yourself. Any of the above methods will work.

In conclusion let me wish you good luck with your Rapier and may you have as many enjoyable hours flying it as I have had. ●

THE GRADUATE

(continued from page 18)

the glass. Stop heating now and let cool for 5 min. Take a large, long (not round) balloon. Blow it up to full size and hold it for 5 min. to let the rubber expand. It will make it easier to put on the foam. Now with the form in a vise pointing up, slowly push the balloon down until it won't go anymore. Let some air out and push again. Do this until the balloon is past the bottom of the form and then let all the air out. Put some tape on the bottom of the balloon so it can't slip up on the form. Again take the hair dryer and heat the form so that the epoxy will even out. Not too much heat or you will break the balloon. After 24 hours the epoxy will be set and you can remove the balloon. You will have to cut the cowl off the form. Cut and trim to fit the fuselage and finish it with the rest of the plane. This is basically known as the Easy-Does-It balloon method. If you take your time and follow instructions you will be proud of your own fiberglass cowl.

Wing: Cut all ribs by stacking 3/32" blanks together and cut with a band saw or jig saw. When cutting ribs be sure to cut the ribs with the construction tab on them. This will insure a warp free wing. Lay down the bottom ¼" x ½" spar and add all ribs. Install the top ¼" x ½" spar. Cut a 3/32" x 3" x 36" sheet to length and then in half to give two pieces of 3/32" x 1½" x 26½". This will give you the top and bottom T.E. sheeting. Install the bottom T.E. sheet and 3/16" x ½" T.E. stock on top of it. Now add the top T.E. sheet. Cut a piece of 3/32" x 3" x 36" wood to length and then trim it to 2½" wide. You will need four for the top and bottom L.E. sheeting so cut all at one time. Add the top L.E. Sheeting and all top sheeting. Glue in the 3/4" triangular L.E. The bottom edge will lie on the building surface. Glue in the 1/16" vertical webbing. Use the 1/16" left over from the top and bottom sheeting from the stabilizer. Add the cap ribs and let the glue dry overnight. After all is dry, flip the wing over and add the L.G. blocks and 3/32" vertical webbing. Cut the construction tabs off and add the bottom sheeting. Sand the center section of the wing by blocking up each wing 1 inch to the proper angle. Add the center section braces and glue the two wing halves together. Cover it with 3" wide fiberglass. The ailerons are made from 1" wide, ¼" thick sheet. The wing tip plates are made from 1/16" ply and just about any shape will do. The ply will protect the wing tip when the engine is started with the ship

standing on the wing tip. When the engine is started in this manner it is less dangerous than starting it upside down.

Stab: The stabilizer is built on top of the bottom 1/16" sheeting which is made by butt gluing a 3" wide to 1½" wide stock. Add L.E., T.E. and ribs. Add the top sheeting and let dry for 24 hours while pinned down to a flat surface. Make the elevator from ¼" stock and sand to shape. The stabilizer and fin are now glued to the fuselage using Tite-bond.

Finish: The entire ship is given two coats of clear dope before covering. I used silkspan on the entire ship except for the turtle back and the wing. Silk was used on the turtle back and Super MonoKote on the wings. Yes, that's right, I use two coats of dope under Super MonoKote. Two more coats of clear on top of the covering and you may do as you wish from here on out. **Don't** go overboard. Keep it as light as possible. Mine weighed 4½ pounds although I think it would fly as good at 5½ lbs.

Bend up the L.G. as shown on the plan making one left and one right. The tail wheel assembly is made with a piece of 1/16" I.D. nylon tubing inside brass tubing. 1/16" wire is bent to shape and soldered in the nylon at each end using small eyelets. Drill a 1/8" diameter hole in the tail post and insert the tail wheel assembly approximately 1/8" deep. Put epoxy on the brass tubing and push the assembly all the way in. Don't get any epoxy on the eyelets. This assembly has proven to be a very neat and workable tail wheel.

Install your equipment. I'm not going to say much here because the manufacturers state the proper way to install their individual systems. Keep the aileron movement to 3/16" up and down for the first flight.

Flying: Test your equipment before flying. If everything is satisfactory, then let's go. Get the feel of the ship on the ground by taxiing. You will find, in a good wind, the Graduate will weathervane a good bit. Head her into the wind and give full throttle. Hold some right rudder until you build up speed. In about 50 to 100 feet she will be airborne and, if in trim, flying flat out. Gain some altitude and have a ball. To land just cut the gas and come on in. You will find it a little faster than you are used to. If you do slow it down, you will find it won't drop a wing at any speed and you will have full control at all times. The Graduate wants to fly a little fast because of its low drag. So far I have been talking to you about the Graduate with a .35 in the nose but with a .29 she is a dream to fly and does fly much slower. ●