SPIRIT OF THE SPRINGS

Evolved over years of flying, this simple-to-build, functional airplane is extremely popular in the Rocky Mountain area, with two local clubs selecting it as a standard design for sport and a special QM event. ■ Jack Aycock

In this line-up of eight club entries at Pikes Peak RC Club race, six are Spirits. Anteater nose is low drag. All pictures by J. de Vries.

WANT a sport airplane, a quarter-midget racer, an airplane that'll perk up club activities? Try a Spirit of the Springs! Over the years it has earned an admirable reputation here in the Rocky Mountain area. Over 25 planes have been built locally and all flew "off the board." We fly at altitudes of over 6,000 feet and not one negative report!

The Spirit was originally presented in the May 1972 issue of *R/C Modeler* and then put in kit form by Fibre Foam. Not quite satisfied with the construction and performance, I started making changes to the original while still keeping the general outline. The first of what would be a series of modified planes was flown in late 1972 and with subsequent years came more alterations and better performance.

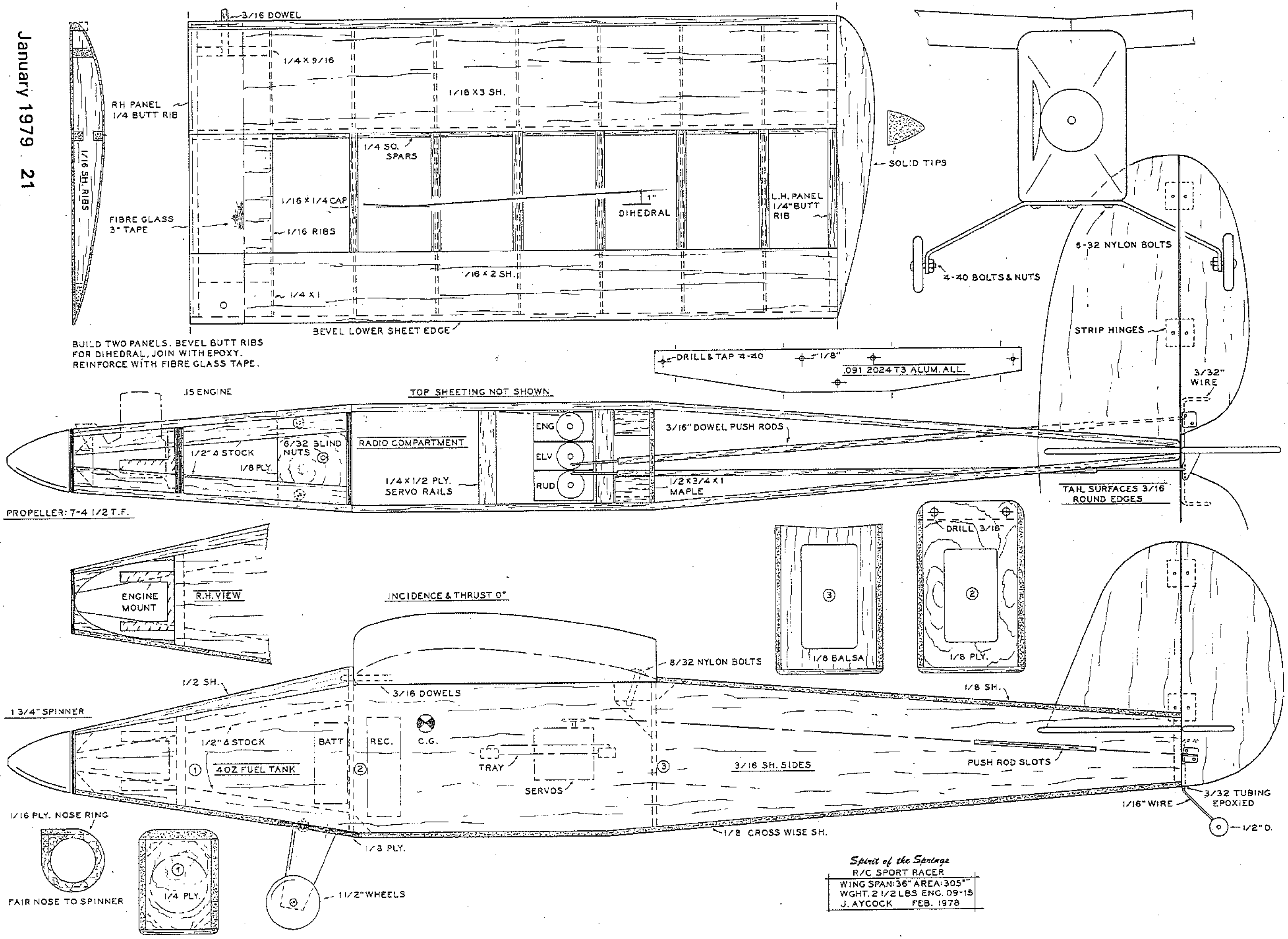
This airplane has a lot going for it. It can be built in ten working hours, costs less than $25.00 including covering and hardware, and is multi-purpose. Build it in your hand using all standard size wood—maybe you have most of the parts in the scrap box. The Spirit has a knock-off landing gear and a huge RC compartment though it only requires a 3-channel radio. What a spot for those large servos stuck in a drawer. It also makes a great little taildragger trainer.

If your appetite hasn't been whetted yet, think of a club fun-fly limited to Spirits only. Two Colorado clubs have gone one better and will be hosting a new class of quarter-midget racing with this airplane.

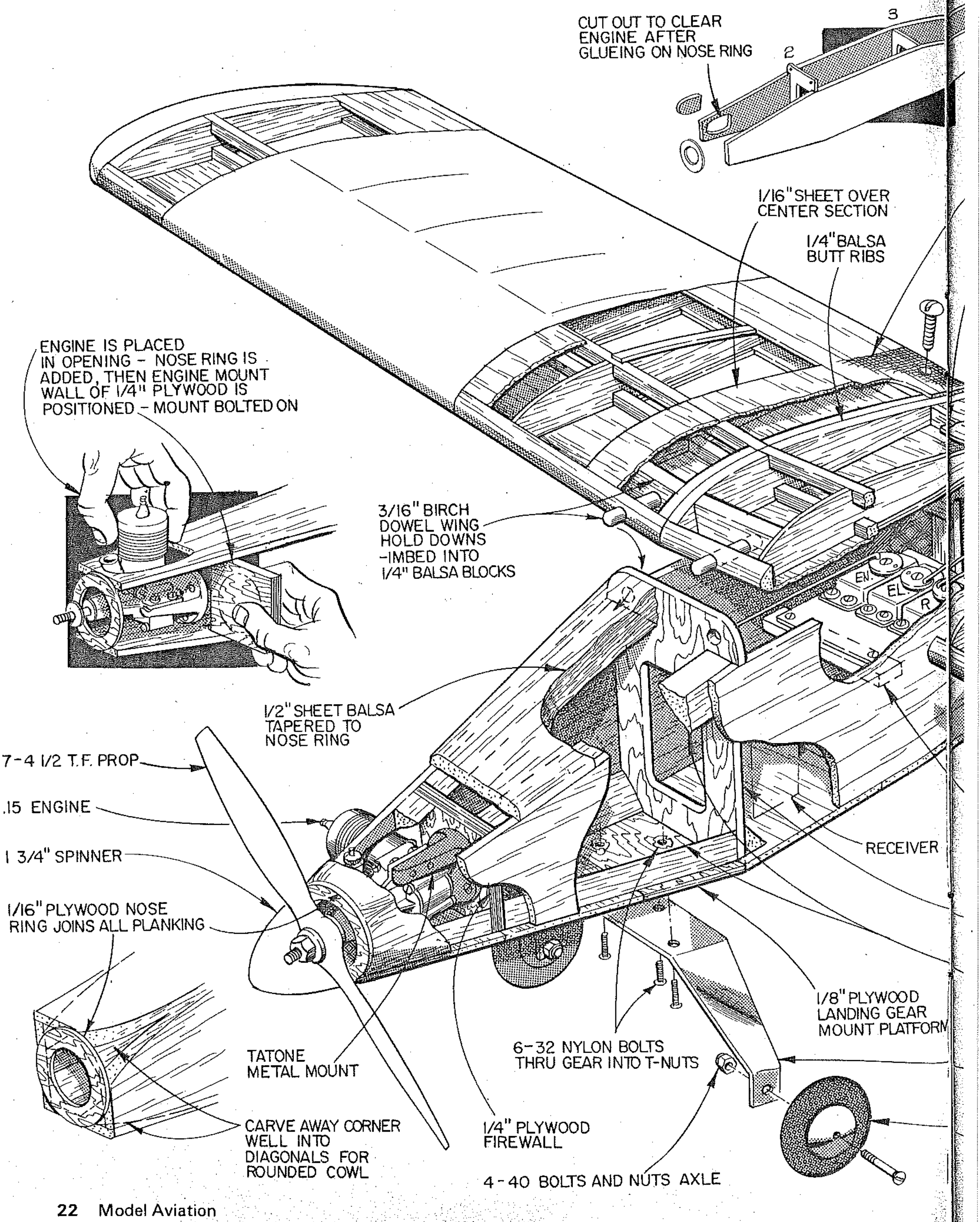
The enthusiasm over the Spirit has the Pikes Peak and Pueblo Sky Corral R/C clubs jointly sponsoring a "Standard" (sounds better than novice or beginner) class as part of their regular AMA sanctioned QM contest and must use Spirits, as per the plans with no modifications allowed. Local hobby shops have free plans available. Both clubs unanimously agreed on the one plane (engine choice left to the contestant) thereby encouraging someone who otherwise might be afraid to compete because of more expensive, harder to fly and faster airplanes.

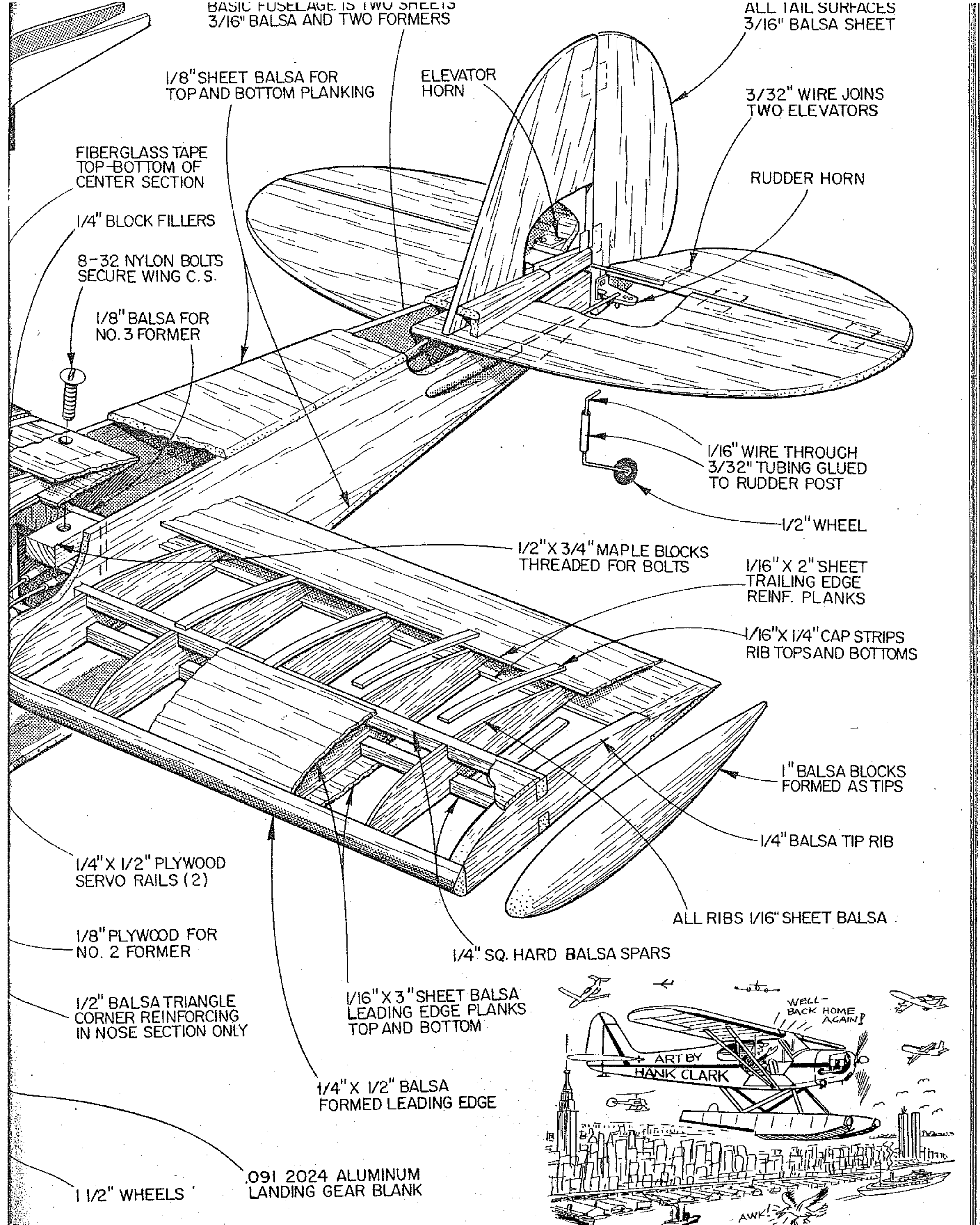
A minimum of five races will be run in conjunction with the clubs regular QM schedule. (Editor's Note: This article was written just prior to the 1978 season.) Points awarded will be cumulative throughout the season with attendance at each contest a must to be a winner. Consistency will be the big factor. Help from the "hotshots" will be available in the form of callers, needle setters and just plain cheering! Two local hobby shops, Custom Hobby and Pachak Hardware are sponsoring merchandise prizes to the winners at the end of the season. A good way to get people into racing? You bet! The clubs are anticipating 20 or more participants in the first standard class and, hopefully, next year these same people will have had enough experience that they will join us in

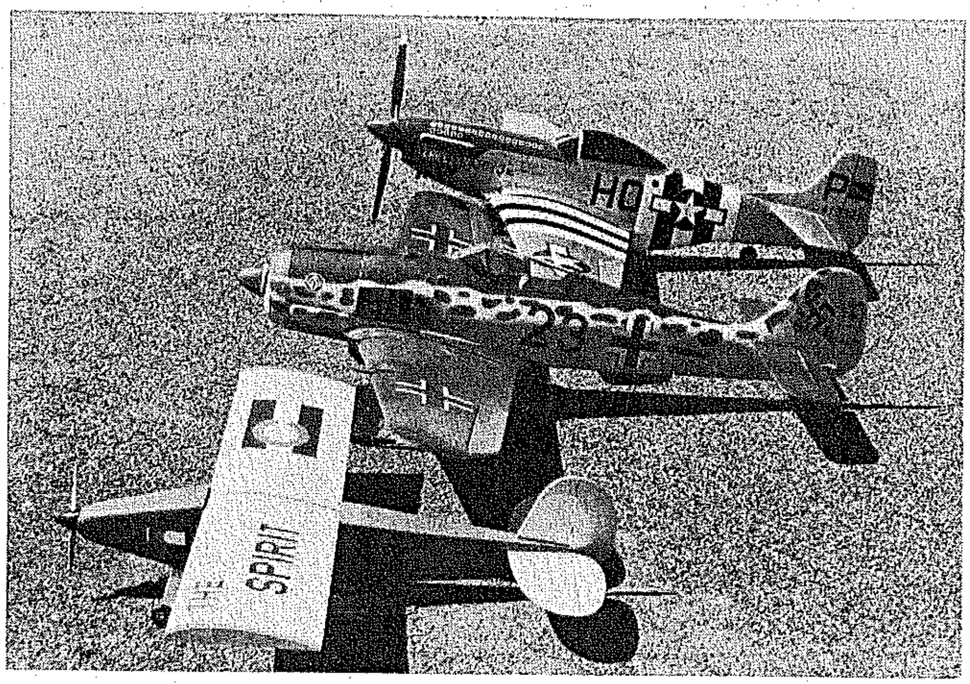
Bill and John Turner, Pikes Peak club members, crank up the Rossi 15-powered Spirit for author.



FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 112


CUT OUT TO CLEAR ENGINE AFTER GLUEING ON NOSE RING
3
2
1/16" SHEET OVER CENTER SECTION
1/4" BALSA BUTT RIBS
ENGINE IS PLACED IN OPENING - NOSE RING IS ADDED, THEN ENGINE MOUNT WALL OF 1/4" PLYWOOD IS POSITIONED - MOUNT BOLTED ON
3/16" BIRCH DOWEL WING HOLD DOWNS -IMBED INTO 1/4" BALSA BLOCKS
EN.
EL.
R
1/2" SHEET BALSA TAPERED TO NOSE RING
7-4 1/2 T.F. PROP
.15 ENGINE
1 3/4" SPINNER
1/16" PLYWOOD NOSE RING JOINS ALL PLANKING
RECEIVER
1/8" PLYWOOD LANDING GEAR MOUNT PLATFORM
6-32 NYLON BOLTS THRU GEAR INTO T-NUTS
TATONE METAL MOUNT
CARVE AWAY CORNER WELL INTO DIAGONALS FOR ROUNDED COWL
1/4" PLYWOOD FIREWALL
4-40 BOLTS AND NUTS AXLE


BASIC FUSELAGE IS TWO SHEETS
3/16" BALSA AND TWO FORMERS
ALL TAIL SURFACES
3/16" BALSA SHEET
1/8" SHEET BALSA FOR
TOP AND BOTTOM PLANKING
ELEVATOR
HORN
3/32" WIRE JOINS
TWO ELEVATORS
FIBERGLASS TAPE
TOP-BOTTOM OF
CENTER SECTION
RUDDER HORN
1/4" BLOCK FILLERS
8-32 NYLON BOLTS
SECURE WING C.S.
1/8" BALSA FOR
NO. 3 FORMER
1/16" WIRE THROUGH
3/32" TUBING GLUED
TO RUDDER POST
1/2" WHEEL
1/2" X 3/4" MAPLE BLOCKS
THREADED FOR BOLTS
1/16" X 2" SHEET
TRAILING EDGE
REINF. PLANKS
1/16" X 1/4" CAP STRIPS
RIB TOPS AND BOTTOMS
1" BALSA BLOCKS
FORMED AS TIPS
1/4" BALSA TIP RIB
1/4" X 1/2" PLYWOOD
SERVO RAILS (2)
ALL RIBS 1/16" SHEET BALSA
1/8" PLYWOOD FOR
NO. 2 FORMER
1/4" SQ. HARD BALSA SPARS
1/2" BALSA TRIANGLE
CORNER REINFORCING
IN NOSE SECTION ONLY
1/16" X 3" SHEET BALSA
LEADING EDGE PLANKS
TOP AND BOTTOM
1/4" X 1/2" BALSA
FORMED LEADING EDGE
.091 2024 ALUMINUM
LANDING GEAR BLANK
1 1/2" WHEELS
WELL-
BACK HOME
AGAIN!
ART BY
HANK CLARK
AWK!



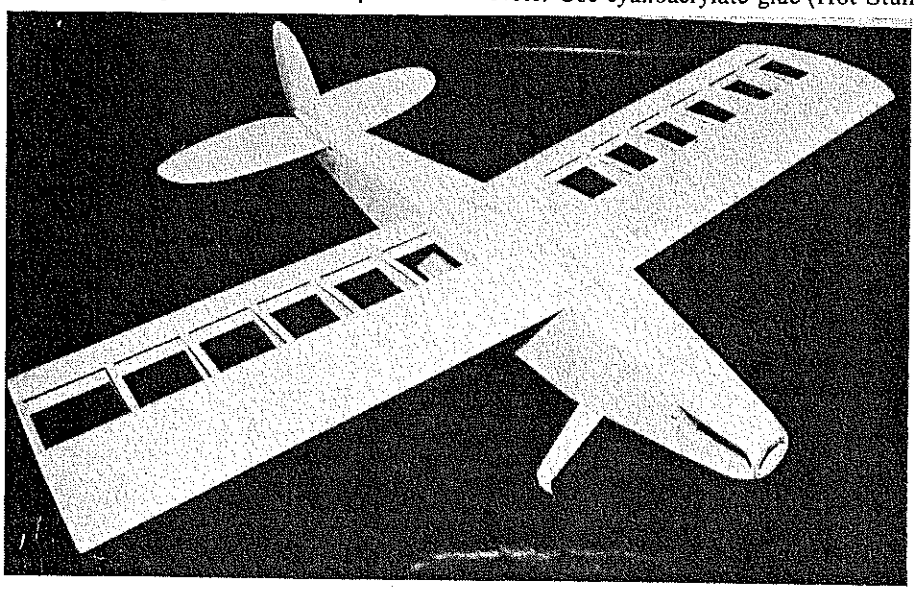
The Spirit was in good company at Pikes Peak site. Robert Heitkamp supplied the stand-off P-51 and FW-190—and aren't they lovely! All three of the ships fly as well as they look.

AMA QM racing.

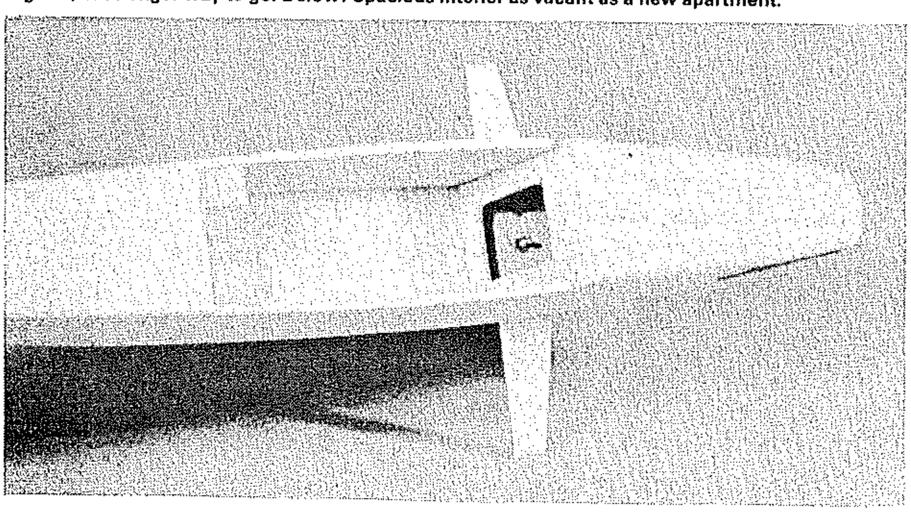
If you haven't skeletons in the closet how about a Spirit in the workshop?

Construction: Select two medium grade 3/16 × 4 × 36 sheets and pin together. Note: Use cyanoacrylate glue (Hot Stuff, etc.) except where noted. Trace the fuselage outline onto these sheets and cut them out. Transfer bulkhead locations. Cut out the fuselage formers using designated wood sizes. Glue formers 2 and 3 in place, keeping everything square. Add the tail post and lower fuselage sheeting up to former 2. Pull together fuselage fronts and center the spinner ring on them. Finish sheeting the bottom of the fuselage, adding ⅛ plywood landing gear block which is epoxied in place. Epoxy ½-triangle stock behind spinner ring. Cut out the right side of the fuselage between the spinner ring and firewall and mark so that a mount can be inserted, pre-drilled for the engine.

Bolt engine to mount, cutting away fuselage as needed for clearance. Add a spinner to the engine and center it on the spinner ring. Allow 1/32 clearance between spinner back plate and front of fuselage. With engine on mount and spinner centered, fit firewall to rear of mount, using epoxy to glue firewall sides. When dry, drill holes for mount in firewall and secure mount with blind nuts and bolts. Epoxy ½-triangle between firewall and former 2. While engine is still in place, drill holes for throttle cable and fuel tank. Remove engine and put fuselage aside for now.



This framework shot hints at the ease and speed of the sturdy construction. There is just no simpler, lighter, or stronger way to go. Below: Spacious interior as vacant as a new apartment.



Trace and cut out the tail feathers. Join the elevators with wire, slot, and install hinges but do not glue yet. Repeat the operation for the rudder. Sand these units by just rounding the edges; no need for an airfoil shape. Fit stab and fin in place on the fuselage, square up and glue. Remove rudder and add the steerable tail wheel. After adding the horns, make necessary pushrod cutouts for rudder and elevator. Remember, the top of the fuselage is not yet planked so you have access to everything. Leave pushrod ends long enough in the RC compartment so that the servos can be shifted later for the correct CG. When satisfied, plank the top.

Cut out and sand the wing ribs. Cut to length the spars, sheeting, and leading edge. Glue ¼ rib to each end of the lower L.E. sheeting. Add lower spar, but do not glue at this point. Measure rib spacing on the sheet and then add 1/16 ribs, keeping them even with the front of the sheet. Glue all this in place. Sounds harder than it is, honest! Bevel lower T.E. and glue in place. Add T.E. filler and dowel support blocks.

Glue top spar in place, then all remaining sheeting—remember, the center section is sheeted. Cap strip the ribs. Glue ¼ × ½ leading edge in place and add optional tip if desired. Sand leading edge to shape. Now do the same thing for the other panel, only make this one with the tip at the opposite end—that way you'll have a right and left panel! Block up each tip and sand in proper dihedral where panels join. Do not increase the dihedral. Epoxy the center ribs together adding the 3″ tape over the center section.

Back to the fuselage. Fit and drill the dural landing gear to the plywood plate.

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be nickle or chrome plated for greater wear resistance. Almost all crankcases are die cast or investment cast aluminum, heat treated for maximum strength. If piston rings are used, they are made of high strength centrifugal cast iron and used in combination with a chrome plated steel sleeve.

Almost all of these ideas were first used in Control Line Speed engines where the quest for superior performance is a continuous process. Extremely high-nitro content fuels are devilishly hard on engine components, so ever stronger alloys and design improvements had to be developed. The success of such work is amply demonstrated in today's large RC engines that develop over one and one-half horsepower on 10% nitro fuels, and run for hundreds of hours before parts wear out or destruct.

Most small engines of .19 displacement or less have cast iron pistons and free-machining leaded steel sleeves. This combination works very well; the cast iron is wear resistant and exhibits low friction. The cast iron is heavy, however, and it is almost impossible to balance a larger displacement engine if you try to use this material for the piston. That is the reason all engines of .40 displacement and larger have aluminum pistons.

ABC and ABCD: several manufacturers now make what are called ABC engines. These letters stand for Aluminum, Brass, and Chrome, and mean that the engine has a lapped aluminum piston in a chrome-plated brass sleeve. The aluminum piston is a special alloy containing 19 to 22 percent silicon, and this alloy has a much lower coefficient of expansion than regular aluminum alloys. In fact, the brass expands more than this aluminum when heated, so proper sleeve and piston clearances are maintained at all operating conditions.

This concept was first used in the Supertigre 65 and 29 engines about ten years ago. I believe Dick Hall, of Huntsville, Alabama, provided the information on the low-expansion aluminum alloy, and Mr. Garofali worked out the technique of the brass sleeve for use in his racing engines. The lapped, lightweight, low-friction piston gave a tremendous increase in horsepower, with side benefits of excellent lifetime and elimination of long break-in requirements. The ABC sleeve and piston are expensive, however, since the high silicon alloy piston must be cast, the chrome plating is difficult to hone, and assembly tolerances are very critical. To reduce some of the costs, some manufacturers made "ABCD" engines.

The letters ABCD mean Aluminum, Brass, Chrome, and Dykes ring. In this combination, the piston alloy is either the high silicon aluminum casting or 2024-T35 aluminum. Instead of being lapped piston, it is fitted with a single compression ring of a special type called a "Dykes" ring. Most piston rings are spring loaded against the walls of the cylinder, and this tension creates friction and drag continually as the piston goes up and down. The Dykes ring, however, fits the bore with no tension, and depends on the combustion pressure to force it against the wall for sealing. It only seals when gas pressure is high, and floats during the remainder of the stroke for a great reduction in friction. Different rings are shown in Fig. 5.

There may be some differences in idling characteristics between a lapped ABC engine and a ringed engine, but I doubt if this would be much of a detriment. I would guess that such differences would be caused by a change in compression at idling speeds. Perhaps the ringed piston leaks slightly at low rpm, and low compression engines seem to idle better than high compression ones. This is only a theory, but could be proven easily by measuring compression at high and low speeds.

Combustion Chambers: Various combustion chamber shapes are shown in Fig. 6. Years ago, we were bothered by preignition if we went to high compression or to fuels containing more than 50% nitro. The flat-top piston eliminated this problem, and now we can run extremely high compression ratios and up to 80% nitro in the racing events! The most successful high performance combustion chamber shape is shown in Fig. 6-d, which was used in Supertigre engines for many years, and is now used in most Schnuerle-ported engines. The distance from the top of the piston to the glow plug has a great effect upon engine performance because it affects temperature of the engine and plug. Many other chamber shapes have been tried. The flat area around the periphery is called the "squish band" and is set to come very close to the piston at the top of the stroke. This "squishes" the fuel-air charge into the domed combustion chamber for high turbulence and increased efficiency.

The trumpet chamber as shown in Fig. 6-f works very well and is used extensively in Cox and Rossi high-performance engines. Some "hop-up" experts modify the squish-band chamber as shown in Fig. 6-e, and claim better performance. I really doubt this, and I think you can get identical or better performance by setting the head clearance for the optimum compression ratio. The weather has a great effect on our racing engines, but you can usually correct for the variations in weather by changing compression ratio. A good tachometer is necessary to measure engine rpm when you vary the clearance, and you must know what rpm the engine should turn for required performance. Sport or RC engines are not as affected by weather changes so compression adjustments on them are rarely needed.

This ends part one; next month we will cover tuned pipes and general descriptions of several new engines on the market.

Spirits/Aycock

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Use 6-32 nylon bolts and blind nuts to hold in place. The use of nylon bolts allows gear to knock off in a super hard landing instead of tearing up the bottom of the fuselage. Epoxy maple wing blocks and gussets in place. Square up wing on the fuselage and drill holes for the wing dowels and bolts. (See why we left off the ½ block on the front of the fuselage?)

Tap the blocks for nylon bolts. Now add the forward fuselage block with epoxy. Install wing dowels. Sand and shape fuselage, fairing the front end into the spinner. Coat engine and tank area with resin or epoxy. Weight at this point should be 15