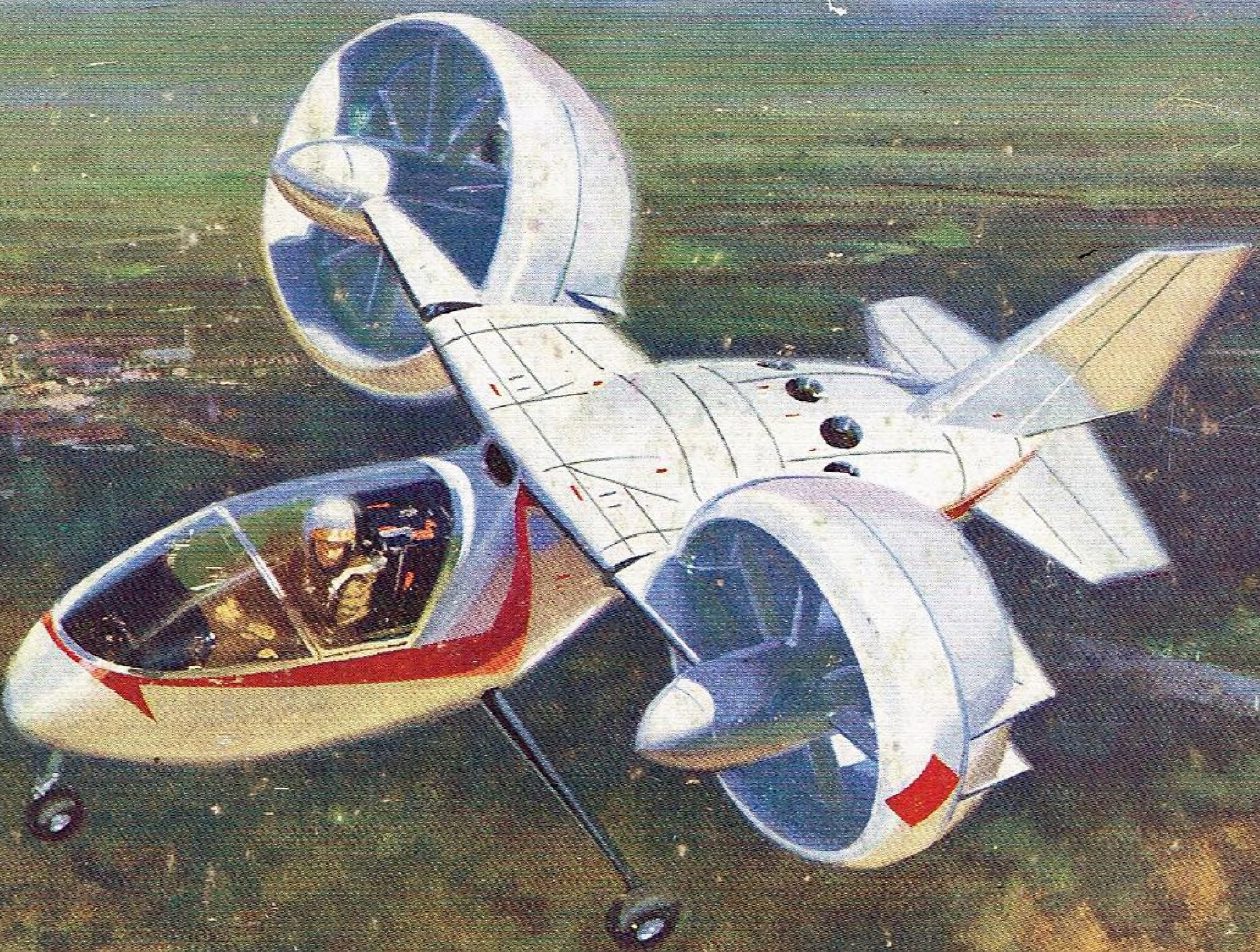
Aero Modeller



Annual 1967-68

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AEROMODELLER ANNUAL 1967-68

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A review of the year's aero-modelling throughout the world in theory and practice; together with useful data, and authoritative articles, produced by staff and contributors of the *AEROMODELLER*

Compiled and Edited by
D. J. LAIDLAW-DICKSON
and
R. G. MOULTON

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AEROMODELLER ANNUAL 1967-68

acknowledges with thanks the under-noted sources, representing a selection of the world's aeromodelling literature.

AMERICAN MODELER	*U.S.A.*
FLYING MODELS	*U.S.A.*
I.M.A.C. NEWSLETTER	*U.S.A.*
MODELAR	*Czechoslovakia*
MODEL AIRPLANE NEWS	*U.S.A.*
MODELE MAGAZINE	*France*
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KRILYA RODINY	*U.S.S.R.*
VANCOUVER M.A.C. NEWS	*Canada*
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LE MODELE REDUIT D'AVION	*France*
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MODELARZ	*Poland*

and club enthusiasts throughout the world.

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CONTENTS

INTRODUCTION

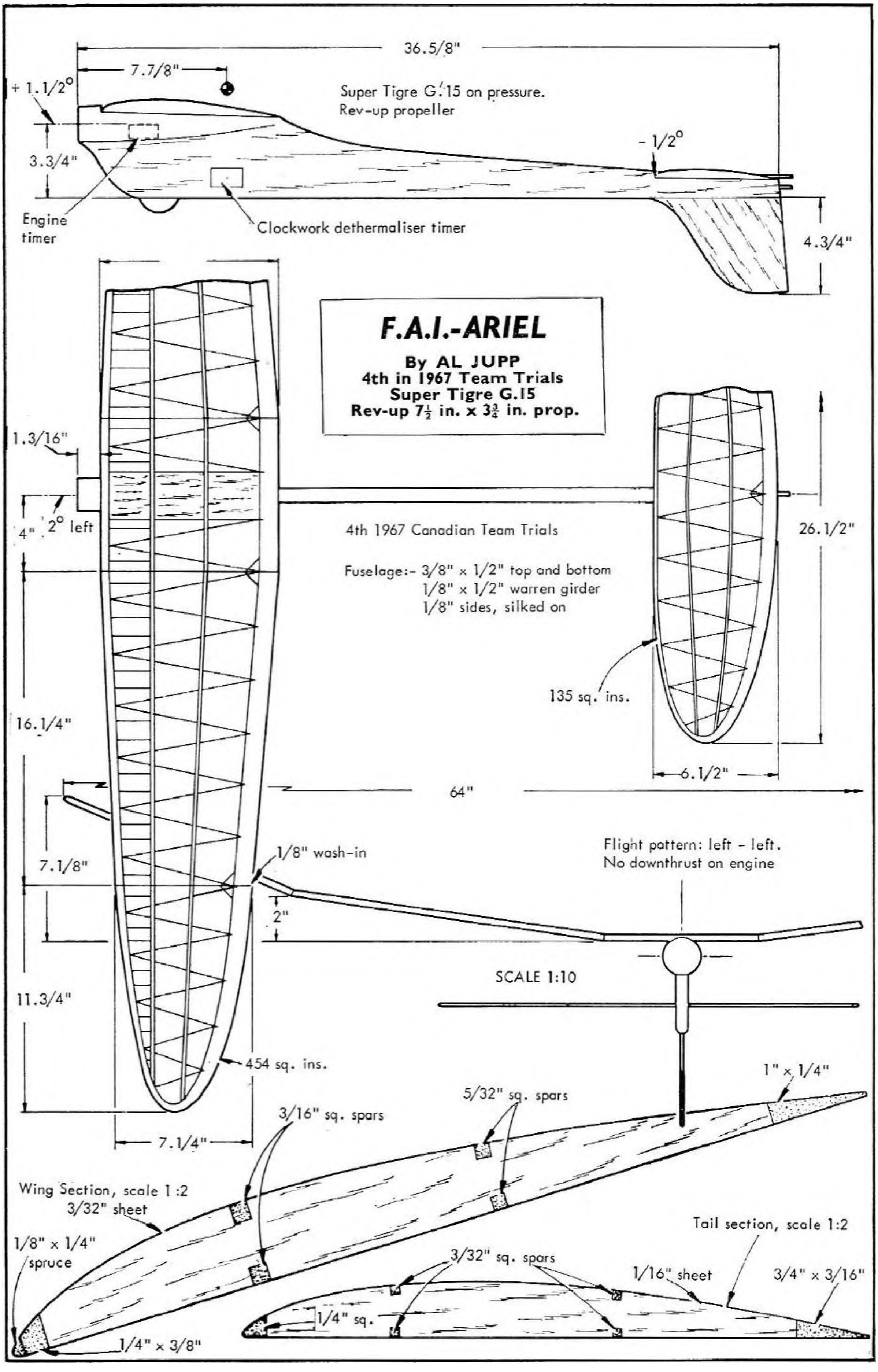
WE are always conscious that the competition side of aeromodelling is only a single facet of a manysided hobby, yet, year after year, as we attend the National Championships—again this year at R.A.F. Hullavington, thanks to kindly R.A.F. co-operation —we look at the milling crowds and wonder if perhaps we are wrong after all and the competition side is indeed the dominant one! In unpromising weather conditions, which never in fact got anything like as bad as pessimists feared, the huge airfield was packed on both days of the meeting. We stopped counting caravans and tents at about halfway with a total of over 600; even if the cars may have looked more for being badly parked there were still a lot of them. The model trade too appeared in force, so that some areas looked more like an Arab market than a model flying meeting . . . but they all did marvellous business if reports be true, far better than they could have hoped for in half a dozen ordinary "at home" weekends.

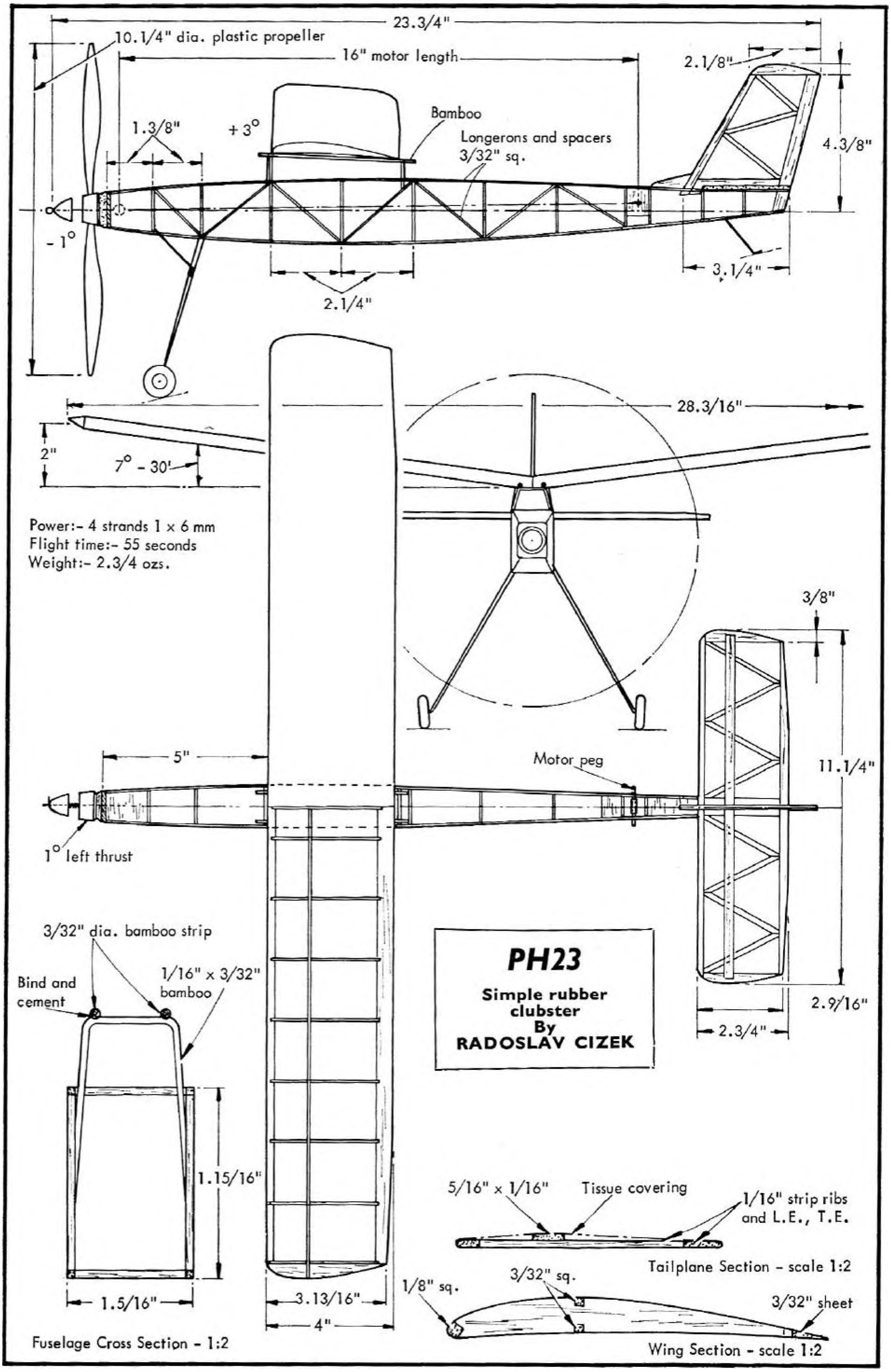
A hobby attracting so prosperous and numerous a throng must indeed be thriving and we were delighted with it all. Only in the actual contest participators was there cause for concern . . . all these visitors, all this flying, all these magnificent models, yet entries were comparatively modest, with many of the old faithfuls continuing to occupy the top places. Following the pattern already clear in 1966, radio control scale models were the most appealing and can now do everything that special "contest" designs achieve besides looking much more beautiful. . . . But all in all the crowd for the most part were there to see and enjoy flying, either their own or their friends' modest efforts rather than take active pothunting part. This indicates to us a trend we have been experiencing for many years, a natural friendliness of aeromodellers who like to congregate where other flyers are, talk about model flying, fly a sports model or two and have a thoroughly good time. Perhaps the time has come for our governing body the Society of Model Aeronautical Engineers to recognise this basic truth.

At the present time a great deal of the Society's efforts and funds are devoted to promoting contests for a small proportion of its adherents. A few earnest officers are overworked, striving to feed the contest cuckoos in their nest to the possible detriment of the rank and file of young flyers who also have needs, but lack the skill to make their needs known. We know of many cases where the governing body has done yeoman work in convincing local authorities of the duty to provide flying space for their young people . . . in most instances voluntary officers of the S.M.A.E. are to the forefront of appeals (supported by the local club members who do their best) but little is heard of this activity, and so much more could be done. We learn too of cases of injury and even fatality through careless flying. Education in the right way and places to fly would save young lives, and a proper knowledge of insurance cover available is desirable to provide adequate compensation for injuries received.

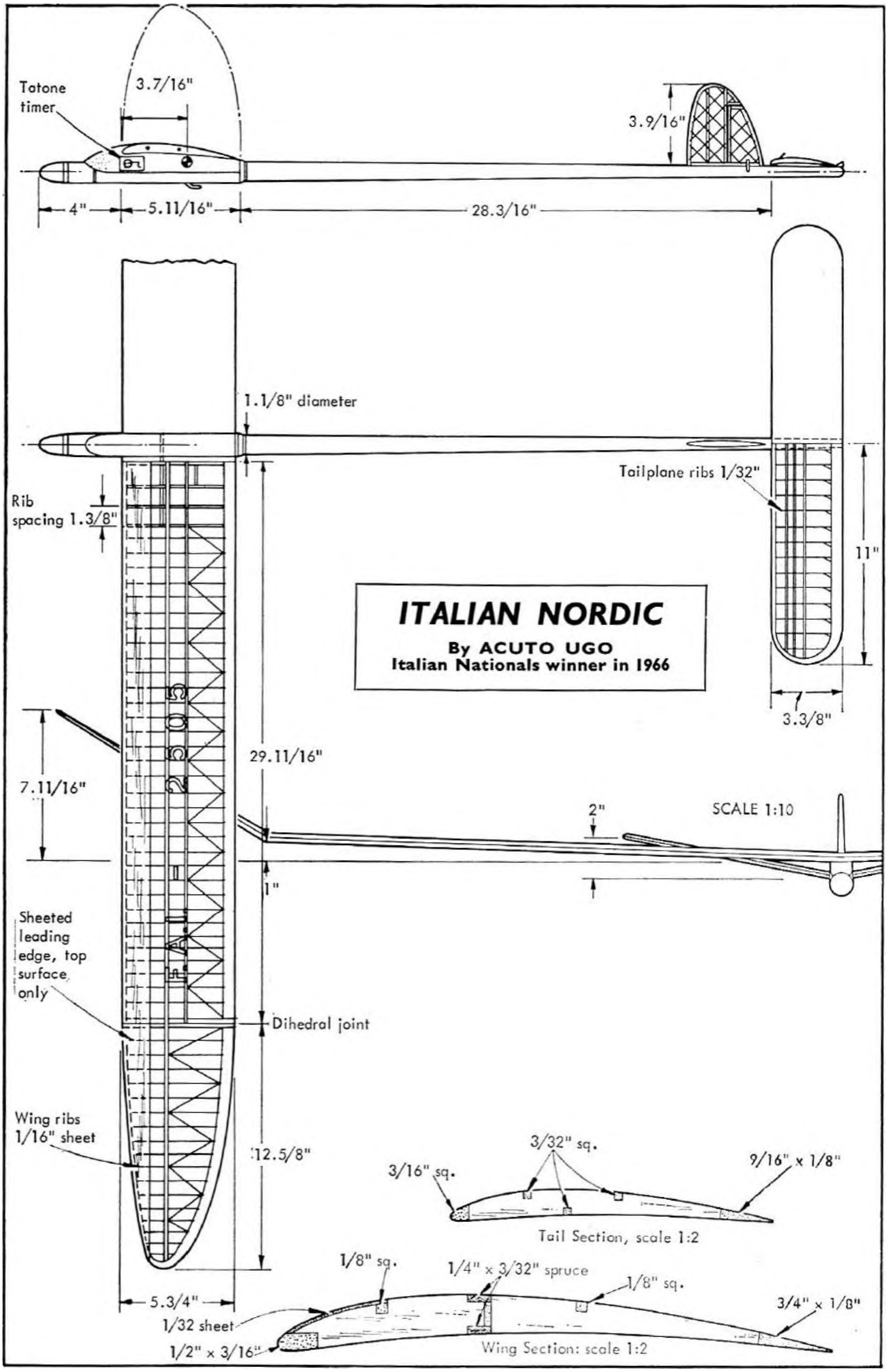
Our own magazine group offers third party insurance cover to its regular readers, the S.M.A.E. offers similar cover as part of membership fees which finance much of its activities. Some pooling of administrative skills and joining up for mutual interests seems indicated. In the past we have found this a problematic field of effort (not everyone believes that our particular axe to grind is an unimportant aspect) . . . but we do have indignant readers telephoning at all hours of the day and night demanding assistance as a right and telling us we are "public servants" . . . this is another aspect of our image that we should really like to cultivate. . . .

In the international field, as we go to press the World Radio Control Championships have taken place in Corsica—first time ever there!—with mixed reports of the conduct of the meeting . . . though Phil Kraft of U.S.A. was a universally applauded winner . . . then there are the Free Flight Championships during August in Czechoslovakia, a host country of enthusiasts who have always made the modelling world particularly welcome . . . and the Belgian Criterium for control line, Europe. International contests undoubtedly improve the breed, and provide welcome publicity in newspapers and television, so that our hobby is not quite unknown when we seek to soften the hearts of the Mayor and Council of Puddleville U.D.C. and obtain the much needed flying field (not on the site of the old rubbish dump please Mr. Town Clerk!). . . .

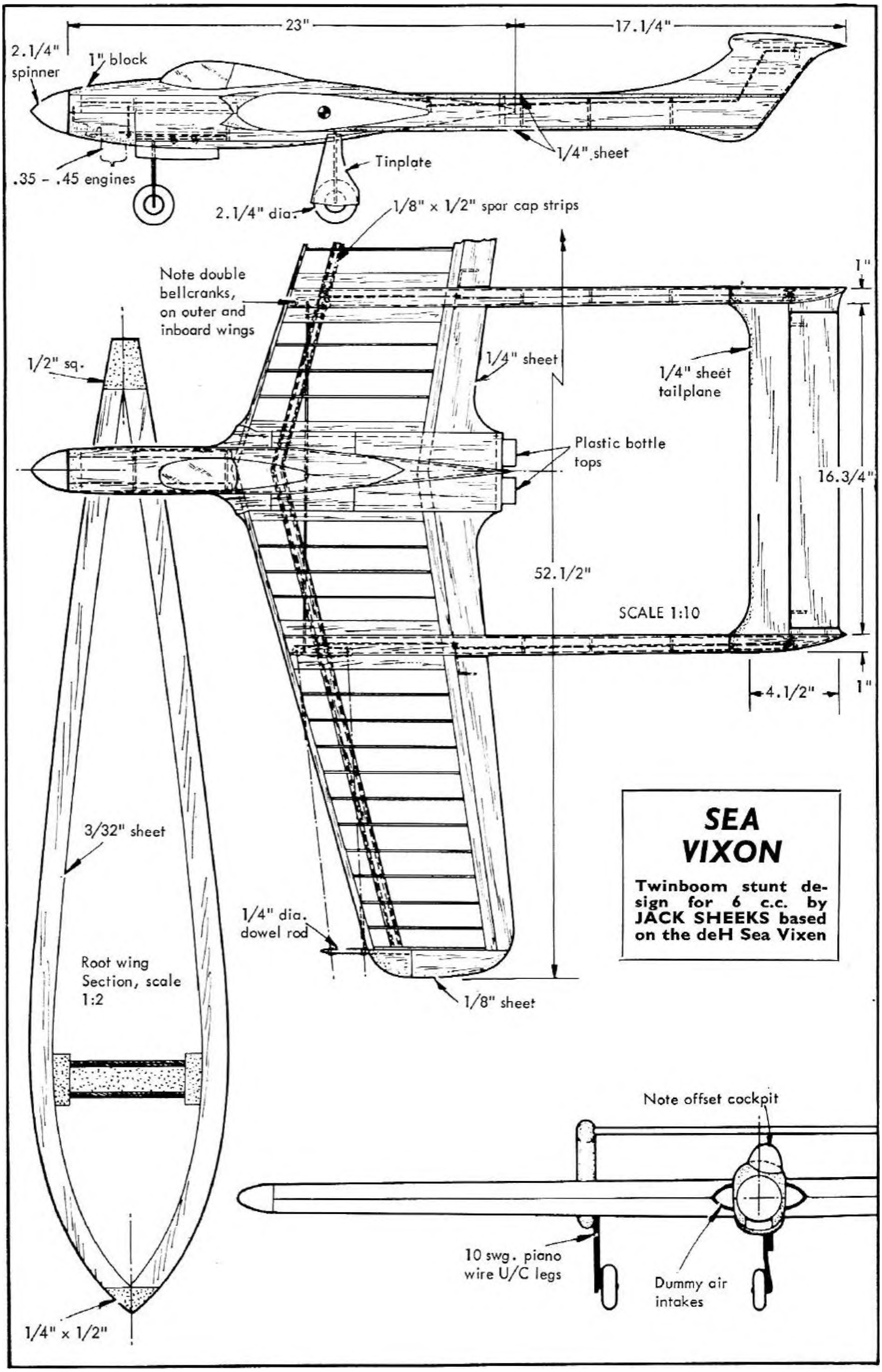

36.5/8"
7.7/8"
+ 1.1/2°
Super Tigre G.15 on pressure.
Rev-up propeller
3.3/4"
- 1/2°
Engine timer
Clockwork dethermaliser timer
4.3/4"
F.A.I.-ARIEL
By AL JUPP
4th in 1967 Team Trials
Super Tigre G.15
Rev-up 7½ in. x 3¾ in. prop.
1.3/16"
4"
2° left
4th 1967 Canadian Team Trials
Fuselage:- 3/8" x 1/2" top and bottom
1/8" x 1/2" warren girder
1/8" sides, silked on
26.1/2"
135 sq. ins.
16.1/4"
6.1/2"
64"
7.1/8"
1/8" wash-in
Flight pattern: left - left.
No downthrust on engine
2"
SCALE 1:10
11.3/4"
454 sq. ins.
1" x 1/4"
5/32" sq. spars
3/16" sq. spars
7.1/4"
Wing Section, scale 1:2
3/32" sheet
1/8" x 1/4"
spruce
Tail section, scale 1:2
3/32" sq. spars
1/16" sheet
3/4" x 3/16"
1/4" sq.
1/4" x 3/8"



CZECHOSLOVAKIA



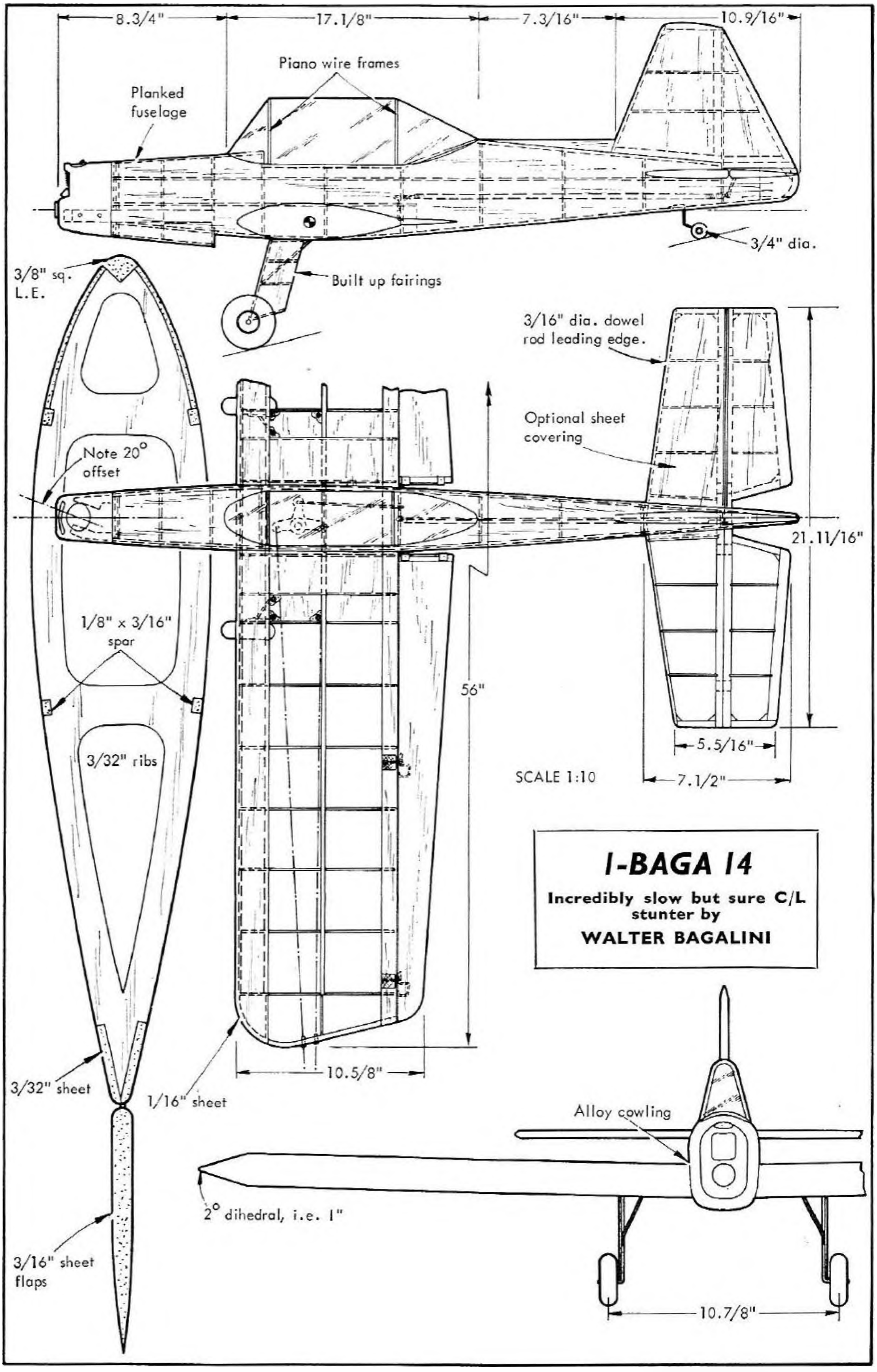
Tatone timer
3.7/16"
3.9/16"
4"
5.11/16"
28.3/16"
1.1/8" diameter
Rib spacing 1.3/8"
Tailplane ribs 1/32"
11"
ITALIAN NORDIC
By ACUTO UGO
Italian Nationals winner in 1966
3.3/8"
7.11/16"
29.11/16"
2"
SCALE 1:10
1"
Sheeted leading edge, top surface only
Dihedral joint
Wing ribs 1/16" sheet
12.5/8"
3/32" sq.
3/16" sq.
9/16" x 1/8"
Tail Section, scale 1:2
1/8" sq.
1/4" x 3/32" spruce
1/8" sq.
3/4" x 1/8"
5.3/4"
1/32 sheet
1/2" x 3/16"
Wing Section: scale 1:2



SEA VIXON

Twinboom stunt design for 6 c.c. by JACK SHEEKS based on the deH Sea Vixen

"FLYING MODELS"—U.S.A



I-BAGA 14

Incredibly slow but sure C/L stunter by
WALTER BAGALINI

"MODELLISTICA"—ITALY

The author at work and at play! Left with Craig Asher of World Engines for first flights of new ST G-65 . . . flights were over 180 m.p.h. On the right: Major Roe of 162 Tactical Fighter Squadron, Ohio Air National Guard. F-84 F Thunderstreak . . . just a little different. . . .

UPDATING THE STATE OF THE ART OF SPEED FLYING

by Harry L. Roe, Jr.

Fuels, Lubricants and Predictions

Without getting too dramatic, it is noteworthy to say that the science of speed flying is never ending, always changing, and rapidly advancing to a new pinnacle. I use the word "pinnacle" advisedly in that very few new advances in speed will be made beyond the current knowhow contained within the context of this article.

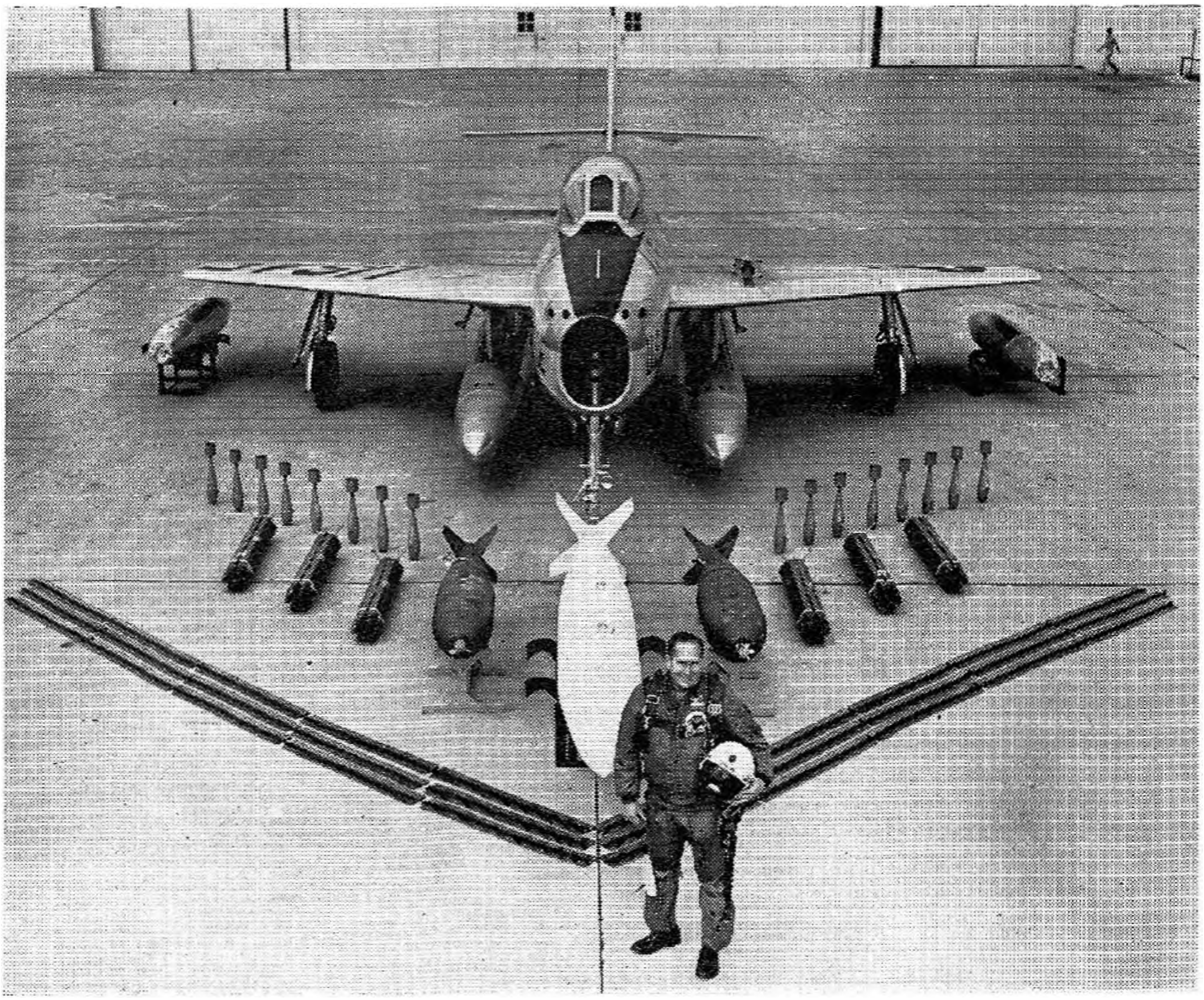
Specifically, speeds will not climb above 186 m.p.h. in 10 c.c.; 175 mp.h. in 5 c.c.; 160 m.p.h. in 2·5 c.c.; 150 m.p.h. in proto; 115 m.p.h. in 0·8 c.c.; or 90 m.p.h. in 0·8 c.c. proto. Again, specifically speaking, the end is now in sight on fuels and lubricants and their contribution to higher speeds. Namely, now that synthetic lubricants allow pure nitromethane and lubricant miscibility (mixing) to occur, how much "hotter" mixture can you achieve than 80% nitromethane and 20% lubricant mixes? So the limit of power has been realised via the higher nitromethane content fuels. (Incidentally, nitromethane is the most powerful internal combustion, reciprocating engine type fuel in the world. There is none better.) The only way to obtain more power from nitromethane fuel is to oxidise it more completely with higher compression ratios or react it to completeness with an oxidiser such as tetra-nitro-methane. However, TNM has been outlawed for competition, so with quick dispatch, no more power is available through the current usage of fuels and lubricants. Further, without the use of oxidisers, no other fuel is better, or will be developed than the current use of 80-85% nitromethane fuels, and thus, only small incremental increase of speeds will be made, and these will be *engineering refinements only* (*e.g.* tuned exhausts).

Engines . . . Past, Current, and the Future

With the advent of Ray Arden's 1948 glow plug and flat piston ·099 engines, the future of high power engines was firmly moulded. However, this advanced technology remained dormant until the successful appearance of Cox's ·049 engines. Prime reason for Cox's success was high compression coupled with squish dome heads, flat pistons, highly advanced cylinder porting, induction timing, and an excellent exhaust scavenging system. These, plus superior Cox manufacturing techniques and high grade materials, rocked the engine manufacturing world. So, with this pattern established, all other engine manufacturing outfits became mere copycats. Those that did not copy soon lost their trade and were forced out of business.

Fox and K&B, two of the remaining "Big Three" took a quick look at the potential market of high speed (power) engines and decided to redesign. Fox made the 29R, 29XBB, 29X, and finally, the 29RXBB. Most of these engines were advances of some measure.

O.S. has done well and particularly very well with the large R/C engines and their new model "H" designs. In the meantime, while many in the U.S.A. were working hard on trying to get the most out of the domestic racing engines, other foreign competition manufacturers took the "*numbers*" off the McCoy (ETA) and McCoy 60 (Rossi) and redesigned the piston (eliminated the domed piston, though heretofore more superior) to the standard baffle (Torpedo and



Fox) and came up with a more powerful engine. Of course, other changes such as higher compression, bigger venturis and ports, *etc.*, boosted the power, too. But, mainly the increase was due to the piston design change. Further, the MVVS and Carter-Doolings utilised basic American designs again with much improved porting and piston design. Meanwhile, some of the American flyers recognised the possible combinations of engines such as the marriage of K&B and Super Tigre (Rattler); McCoy 29 piston and liners with home-built cases (S&H Specials); "Yellow Jackets" with Mullin pistons and cylinders rendered much improved Dooling 61 machines. Cliff Telford's Mac 65 and many others too numerous to mention brough out a series of home-built specials which upped the speeds over production attempts during the 1959-1964 era. However, most of the wild home building specialists slowly succumbed to the production technology of established firms.

Gradually, Mr. Above-Average-Flyer has again started buying production engines because manufacturers have finally picked up the technical ball and started running again, after a ten to fifteen years mental lapse. This awakening was brought about by the trade competition and somewhat by the direct influence of model engine specialists such as Netzeband, Moir, Nightingale, C. Lee, Stegans, Asher, Kirn, Wisniewski, and many others.

While touching on the subject of production engines, it is most necessary to bring out a point of discussion. It has been this author's experience to note that while most established recognised flyers (record holders and big consistent winners) are always great, but they are not unbeatable. Regardless of how great you are (or how small you are), *anybody* can go to the hobby shop and buy an engine which will beat all the rest, factory specials included. This ratio of great engines is about one in ten. Specifically, if you buy ten engines, you get one great one, one to two outstanding ones, three to five good ones, two to three poor ones, and one to two lousy engines. *No one*, repeat *no one*, can take any of these engines and rework, hop-up, polish, port, chrome, rebuild, rebore, re-align, retime any of the other nine engines and make 'em go as fast as the *one* great engine.

As far as weather conditions are concerned in speed flying, I can only say that I have set records on hot days, cold days, warm days, humid days, dry days, and extreme conditions of the above. Therefore, I will make a straight-forward statement based on my experience that I fly the same speeds in all classes under *any* and *all* atmospheric conditions. Thus, weather makes no difference in speed flying and will not change the maximum velocity of a speed model at all (provided the temperature range is ABOVE 50° F.).

Note: Below 60° F., 50% nitromethane base fuels start to separate due to miscibility problems.

Fuel Formulas for Speed Flying

Fuel 1—*Basic fuel—all speed engines—all conditions, and 1/2A*

40% Nitromethane (CH_3NO_2)
40% Alcohol (Methyl Alcohol) (CH_3OH)
20% Castor Oil
NOTE: The above is best for all engines when the temperature is LESS THAN 70° F.

Fuel 2—*McCoy* ·60, *Super Tigre* 15-·29, *ETA* ·29, *K&B*, 15-·29
50% Nitromethane
25% Alcohol
20% Castor Oil
5% Nitro Benzene (C_6H_5NO)
NOTE: The above is best for all engines when the temperature is GREATER THAN 70° F.

Fuel 3—*Break in fuel and new engine test flying fuel*
25% Nitromethane
50% Alcohol
25% Castor Oil

Fuel 4—*Rat Race, Combat, Navy Carrier*
30% Nitromethane
45% Alcohol
25% Castor Oil

Fuel 5—*Stunt, Sport, Free Flight, Radio Control*
10% Nitromethane
65% Alcohol
20% Castor Oil

Fuel formulations have changed so considerably with the accepted use of Union Carbide's LB625 Ucon Oil. Since this is miscible with alcohol and nitromethane in all proportions it is now possible to mix fuels with as much nitro as you desire. Heretofore, 60% nitro content fuel was about tops, and to get high percentage nitro to mix, it was necessary to use nitrobenzene to maintain solution miscibility. Unfortunately, nitrobenzene put out the fire almost to the extent that only a small power boost was achieved using higher (60%) nitromethane content fuels by using 10% nitroethane, 10% nitrobenzene, 20% castor oil, 60% nitromethane, 10% alcohol, the power boost was only incremental. So, to obtain more potent fuels, it was necessary to reduce castor oil content (sacrifice lubrication) or find a new lubricant. Union Carbide's Ucon Oil was the answer. It was first blended with castor oil as a partial replacement, but as the demand for higher nitro content became apparent, castor oil was eliminated altogether. No sacrifice in lubrication occurred, as some sceptics predicted; instead, it was soon realised that it was a far superior lubricant to castor oil due to its clean burn-off and negligible ash content. Further complete elimination of gumming was realised, and most of all this lubricant did not put out the glow plugs as castor oil and nitrobenzene would. In fact, since they are also alcohol-like in chemical structure, they actually aid the plug to glow and believe it or not, actually take part in the combustion process by contributing heat (BTU) to the fire. This all adds up to more power with the bonus of being a better lubricant than castor oil. Summing this up, a real aid to speed model flyers is evident in that it is now possible to launch speed jobs with a much richer needle valve setting than previously possible with castor and nitrobenzene. This allows for higher speeds, of course, since fuel flow and total power fall hand in hand with needle valve settings that become less and less critical at launch. Coupled with the higher factors of much improved engines, bigger ports, higher compression, higher nitro fuels, stronger engines, better lubricants; much higher speeds have become a reality in the last couple of years. So mix your own fuel for maximum power. Mixtures are as follows:

(*Class A*)
Fuel 7—60% Nitromethane
20% Ucon Oil LB 625
20% Alcohol

(*Class B*)
Fuel 8—70% Nitromethane
20% Ucon Oil LB 625
10% Alcohol

(*Class C*)
Fuel 9—80% Nitromethane
20% Ucon Oil LB 625
No Alcohol

Rat Race, Combat
Break in for all engines
Fuel 10—40% Nitromethane
20% Ucon Oil LB 625
40% Alcohol

Formulae 7, 8, 9 are strictly racing formulae. All previous are still good for the events as specified, but formula 10 should be used as a starting break-in fuel over previously specified fuels since it renders much better lubrication! Formula 10 is also the best 1/2A formula.

Note

UCON—LB 625 is sold in the U.K. at the rate of 1 gallon for £5/3/4.
The agencies are:

South Area
Union Carbide U.K. Ltd.,
Penn Place,
Station Road,
Rickmansworth.

North Area
Union Carbide U.K. Ltd.,
Peter House,
Oxford Street,
Manchester 1.

Lines and Pull Test: Speeds and Wire Sizes

Many so-called experts are again kicking around the data on pull test, line failures, line lengths, big speeds, mufflers, FAI fuel. Admittedly, I don't have all the answers posed by the above title, but the foregoing data does prove that I have been around the pylon a couple of times. In fact, I can proudly say that "I have been model flying for over thirty-five years". What's this add up to? In simple language, it adds up to the following four points:

(1) Line lengths need not be changed to reduce speeds. (At the present time.) Thus, current fields need not be enlarged to accommodate longer "C" and Jet wire(s).

(2) We do not need a study of pull test and/or centrifugal forces. References of Fred Randell's and Tom Parry's "Safety First" articles, as appearing in July and August 1960 *Model Airplane News,* show all the pertinent data on pull test, centrifugal forces (both flight tested and calculated values) wire strengths, soldered joints and loops, handle strength, speed and "G" loads, are applicable to today's speeds. Quick survey of this data proves that even with today's high speeds, we are still well within the safety factor of two. Meaning, we fly our models using rules as per engineering requirements for building a bridge; namely, figure out how much load is to be encountered and double its value. This is precisely what we have done in monoline speed flying, so since no one has repealed the natural laws of occurring centrifugal forces, the data is still good and we do not need a big fancy study as some "experts" claim.

(3) I am forty-four years of age and still find it possible to get around a pylon with any speed ship. Admitted, it's getting tougher; speeds are higher and tripping the light fantastic around a pylon is getting to be a healthy chore. For example, consider the one second difference in flying a timed "C" flight of 10·0 seconds vs. 11·0 seconds. This one second represents a whopping 17 m.p.h. but only a lap per rotational increase of ·16 second faster. And while a 2 lb. model flying at 163 m.p.h. pulls 55, a model at 180 pulls 62 so this then compacts considerably more work in a smaller unit of time. So, it does now appear that we should slow down speeds for safety's sake. The way to do this is by simply increasing line diameter thickness, as the following for the U.S. Classes:

EVENT	CURRENT SIZE (MONOLINE)	PROPOSED SIZE
1/2A and 1/2A proto	·012 in.	·014 in.
A	·018 in.	·021 in.
B & B Proto	·022 in.	·024 in.
C & Jet	·028 in.	·030 in.

(4) With the above line diameters, speeds will be reduced on the average of 5 m.p.h. below the *current speed records*. If some new big breakthrough allows a jump in speeds, simply up the diameters again, as required, at a later date, Forecast *record speeds* with the proposed new sizes are:

EVENT	PROPOSED SIZE (MONOLINE)	FORECAST SPEEDS
1/2A Proto	·014 in.	80 m.p.h.
1/2A	·014 in.	105 m.p.h.
A	·021 in.	145 m.p.h.
B	·024 in.	170 m.p.h.
C	·030 in.	175 m.p.h.
B Proto	·024 in.	140 m.p.h.

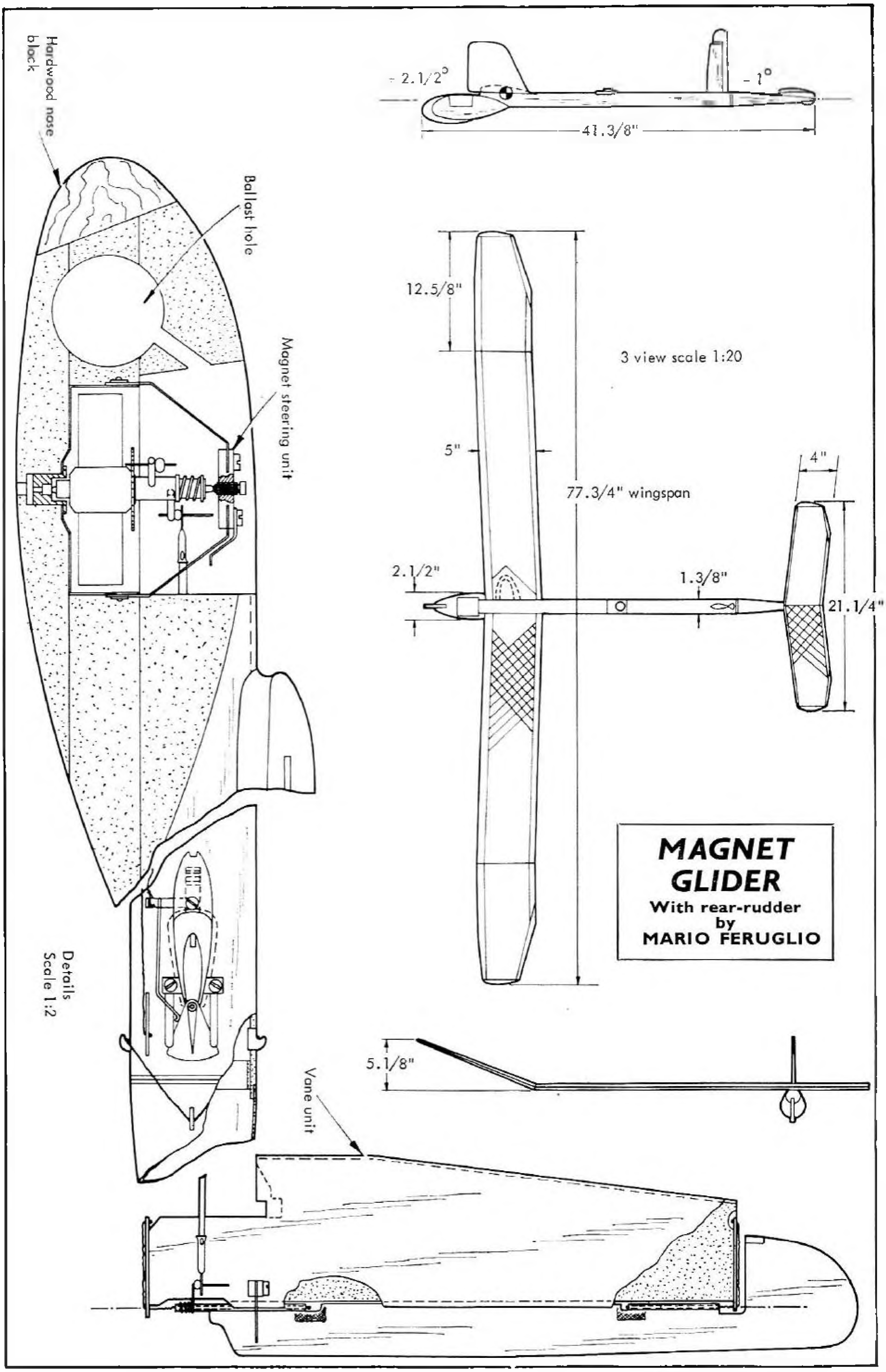
Actually, the average model flyer's speeds will be reduced 4-6 m.p.h. less than the predicted record speeds. This will bunch competition and provide added incentive for many more competitive flyers.

At many contests it is customary to see speed flyers with some rather elaborate speed equipment. Some of this equipment consists of charts and graphs on temperature and humidity, along with special tachometers. Many clubs use tachometers on the ground and in the air to check r.p.m., props, speeds, fuels, and other data, but personally, I never use one and see little use for one. I find trial and error the best and most useful tool, plus the results BASED ON STOP WATCH READINGS. Some fellows have tried the scientific approach on temperature and humidity curves, but found them to be inconclusive and the results are usually hysteresis plots. Actually, I have found that the biggest factor in speed flying outside of needle valve setting is wind velocity. Since total drag is a function of the square of the air speed, the velocity of a model varies as much as 20 m.p.h. on a day with a 10 m.p.h. wind. On a 20 m.p.h. windy day, the air speed velocity will vary almost 40 m.p.h., so a square function of these values will greatly reduce the average speed. Also, when these large velocity changes occur on a windy day, large pitch changes are required to maintain level flight, and this requires large elevator deflections and increased induced drag factors, further resulting in speed losses. With the above in mind, I am sure that wind velocities are a much bigger factor than a 20° change in temperature, or a 10% change in relative humidity, or a ·25 in. change in atmospheric pressure.

Intercooling

I have had many questions on this subject. Intercooling has been used on many supercharged engines for racing cars. It consists mainly of cooling the intake manifold, which in turn cools the fuel mixture. Notice, if you will, that I said it applies to supercharged engines—we are not running supercharged engines. Actually, a hot fuel vaporises faster; therefore, the hotter your fuel, the faster it vaporises and the faster the engine will run. For a fuel to burn, it has to be in a gaseous state, and since the time element of venturi induction for combustion is extremely short, the vaporisation of fuel is incomplete. All model engines run wet at the exhaust port, meaning that a lot of fuel is pumped out of the port that has not been vaporised due to the short time element from induction to combustion. Also, we know that two-cycle engines are not the most economical engine due to port timing overlap. This also accounts for the wet condition that I described, I actually preheat my fuels in two ways prior to flight. One way is by exposing the fuel to the sun, and the other, is to wrap the copper fuel line around cylinder (BETWEEN THE TWO BOTTOM FINS) to absorb the cylinder heat prior to entry into the venturi! It gives a 2-3 m.p.h. over direct induction into the venturi. As far as the Indianapolis cars are concerned and the relation between their inter-cooling and supercharging, supercharging creates tremendous heat and subsequent large gas volumes. Cold fuels and inter-cooling assist in reducing volumes of (compressed) supercharged gases and consequently delivers more mass (pounds of gases) to the cylinders. Since supercharging generates tremendous heat due to the compression of gases, detonation often occurs in the intake manifolds and the cylinder during the compression stroke and auto ignition, pre-ignition or detonation takes place prior to the desired spark ignition. So the colder the fuel and air mixture, the more efficient your supercharger becomes because it has to compress less volume and thus, its output is greater in mass.

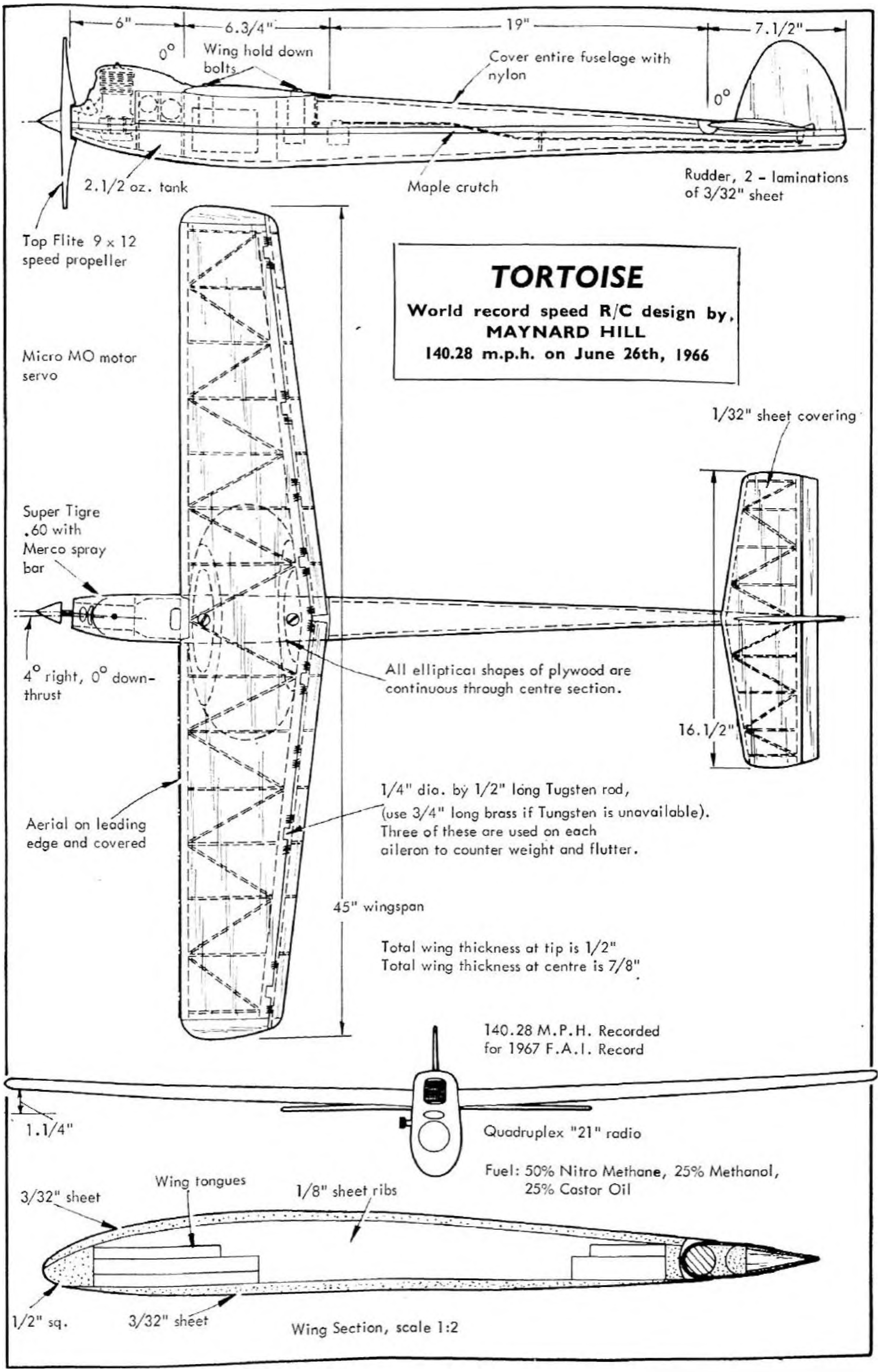
When using my fuel heating system, it is necessary to take more time in setting the needle valve to allow the engine temperature to stabilise. Ten to twenty seconds does the job, and this reduced the critical settings on an engine since it (not the fuel) requires a larger needle valve opening due to its greater heat, liquid, expanded volume.



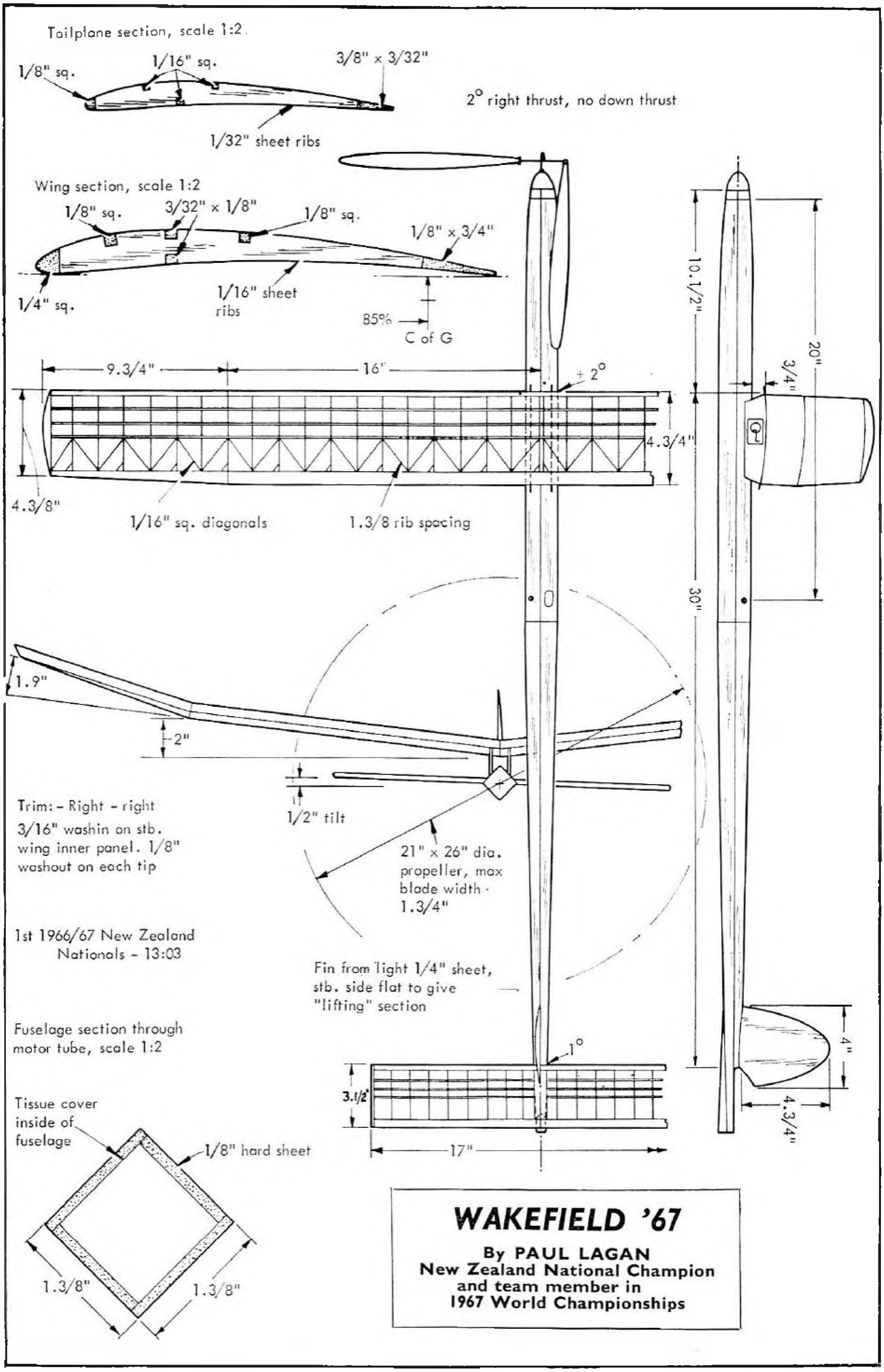
MAGNET GLIDER

With rear-rudder
by
MARIO FERUGLIO

"MODELLISTICA"—ITALY

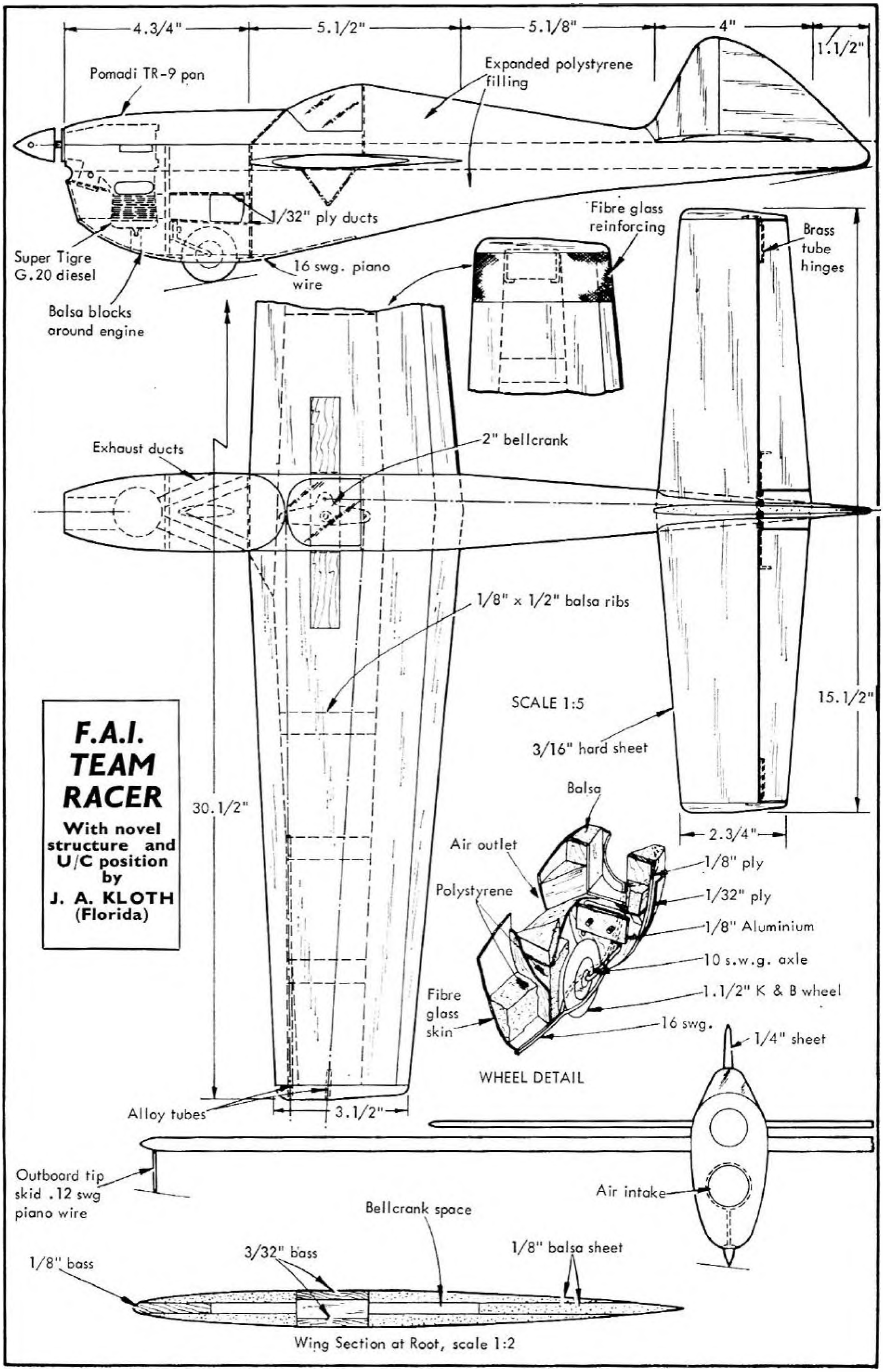


"FLYING MODELS" U.S.A.



WAKEFIELD '67

By PAUL LAGAN
New Zealand National Champion and team member in 1967 World Championships


4.3/4"
5.1/2"
5.1/8"
4"
1.1/2"
Pomadi TR-9 pan
Expanded polystyrene filling
1/32" ply ducts
Super Tigre G.20 diesel
16 swg. piano wire
Balsa blocks around engine
Fibre glass reinforcing
Brass tube hinges
Exhaust ducts
2" bellcrank
1/8" x 1/2" balsa ribs
SCALE 1:5
3/16" hard sheet
15.1/2"
2.3/4"
F.A.I. TEAM RACER
With novel structure and U/C position by J. A. KLOTH (Florida)
30.1/2"
Balsa
Air outlet
Polystyrene
1/8" ply
1/32" ply
1/8" Aluminium
10 s.w.g. axle
1.1/2" K & B wheel
Fibre glass skin
16 swg.
1/4" sheet
WHEEL DETAIL
Alloy tubes
3.1/2"
Outboard tip skid .12 swg piano wire
Air intake
Bellcrank space
1/8" bass
3/32" bass
1/8" balsa sheet
Wing Section at Root, scale 1:2

U.S.A.

WORLD RECORDS

Duration (*Germany*)
G. Friedrich, July 28th, 1966 ... 12h. 2m. 13 sec.

Distance in a straight line (*U.S.S.R.*)
Evgueny Boricevitch, August 14th, 1952 ... ... 378.756 km.

Height (*U.S.S.R.*)
Georges Lioubouchkine, August 13th, 1947 ... ... 4,152 m.

Speed (*Italy*)
E. Zanin, Rome, April 26th, 1964 327 km/h.

INTERNATIONAL RECORDS

Free Flight

RUBBER DRIVEN

Class F-1-B

No. 1 **Duration** (*U.S.S.R.*)
V. Fiodorov at Doubrovitsi, June 19th, 1964 ... ... 1h. 41m. 32s.

No. 2 **Distance in a straight line** (*U.S.S.R.*)
G. Tchiglitsev from Tomsk to Pavlovsk, July 1st, 1962 371.189 km.

No. 3 **Height** (*U.S.S.R.*)
V. Fiodorov at Doubrovitsi, June 19th, 1964 ... ... 1,732 m.

No. 4 **Speed in a straight line** (*U.S.S.R.*)
Vladimir Davidov, July 11th, 1940 at Oufa, September 16th, 1947 ... ... 107.080 km/h.

POWER MODELS

Class F-1-C

No. 5 **Duration** (*U.S.S.R.*)
Igor Koulakovsky, motor KMK-5 diesel 3·3 c.c.; Soumy, August 6th, 1952 ... ... 6h. 1m.

No. 6 **Distance in a straight line** (*U.S.S.R.*)
Evgueny Boricevitch, motor AMM-4, 9,498 c.c. from Borovaya to Demainovo, August 14th, 1952 ... ... 378.756 km.

No. 7 **Height** (*U.S.S.R.*)
Georges Lioubouchkine, motor AMM-4, 9·6 c.c., Silikatnaya, August 13th, 1947 ... ... 4,152 m.

No. 8 **Speed in a straight line** (*U.S.A.*)
Eug. Stiles, motor Triumph 51, 8,226 c.c., Alameda (California) July 20th, 1949 ... 129.768 km/h.

CONTROL LINE

Class F-2-A

Category I (2·5 c.c.)

No. 27 **Speed** (*U.S.A.*)
B. Lauderdale and T. McDonald motor Super Tiger G-20, 2·49 c.c. at Huntsville, Alabama, May 4th, 1963... ... 273.660 km/h.

Category II (2·5 and 5 c.c.)

No. 28 (*U.S.A.*)
T. McDonald, motor K & B-4·8 c.c. at Huntsville, November 15th, 1964 ... ... 288.95 km/h.

Category III (5 and 10 c.c.)

No. 29 (*U.S.S.R.*)
Antoli Kouznetzov, own motor (Leningrad) 9·81 c.c. at Moscow Touchino, September 30th, 1962 ... ... 316 km/h.

JET MODELS

Class F-2-A

No. 30 **Speed** (*Italy*)
E. Zanin, Zanin Jet, Rome, April 26th, 1964 ... ... 327 km/h.

INDOOR MODELS

Class F-1-D

No. 32 **Duration** (*West Germany*)
K. H. Rieke, at Cardington (Great Britain), September 22nd, 1962 ... ... 45m. 40s.

8m. Class

R. Cerny (*Czech.*), March 26th, 1966 ... ... 14m. 37s.

30m. Class

J. Kalina (*Czech.*), September 19th, 1966 ... ... 26m. 40s.

RUBBER DRIVEN HELICOPTERS

Class F-1-E

No. 9 **Duration** (*U.S.S.R.*)
P. Motekaltis, Kivchikas (Vilnus) July 6th, 1963 ... ... 12m. 02s.

No. 10 **Distance** (*U.S.S.R.*)
P. Motekaltis, Kivchikas (Vilnus) July 6th, 1963 ... ... 889m.

No. 11 **Height** (*Italy*)
G. Pelegi, at Novi Ligure, July 21st, 1958 ... ... 205.12m.

No. 12 **Speed in a straight line** (*U.S.S.R.*)
A. Victortchik, Moscow, May 22nd, 1966 ... ... 37.894 km/h.

POWER DRIVEN HELICOPTERS

Class E-1-E

No. 13 **Duration** (*Rumania*)
Stefan Purice, 1 motor Schlosser, 2·5 c.c. at Clincen, October 1st, 1965 ... ... 3h. 12m.

No. 14 **Distance** (*U.S.S.R.*)
V. I. Titlov, motor Ritm, 2·5 c.c., from Kazan to Chikchi, October 1st, 1963 ... 91.491 km.

No. 15 **Height** (*Rumania*)
S. Purice, motor Schlosser 2·5 c.c., at Clinceni, September 24th, 1963 ... ... 3,750m.

GLIDERS

Class F-1-A

No. 17 **Duration** (*Yugoslavia*)
M. Moncilo Milutinovic from Kraljevo to Vrnjcl, May 15th, 1960 ... ... 4h. 58m. 10s.

No. 18 **Distance in a straight line** (*Czechoslovakia*)
Z. Taus from Pizen to Holesov, March 31st, 1962 ... 310.33 km.

No. 19 **Height** (*Hungary*)
Georges Benedek, Rakos (Budapest), May 23rd, 1948 ... 2,364m.

RADIO CONTROL POWER DRIVEN

Class F-3A to C

No. 20 **Duration** (*U.S.A.*)
W. Bertrand, Super Tigre G20 diesel ... ... 11h. 18m.

No. 21 **Distance** (*U.S.A.*)
"Stretcher" by Maynard Hill, motor Merco 61·10 c.c., from Batavia to Canojaharie, New York, October 2nd, 1965 296.356 km. (184·147 miles)

No. 22 **Height** (*U.S.A.*)
"Foo Too" by William C. Northrop Jr., motor Super Tigre 56, at Dahlgren Virginia, September 5th, 1965 ... 5062·7m. (16,610 ft.)

No. 23 **Speed in a straight line** (*U.S.A.*)
M. Hill, June 22nd, 1966 225.75 km/h.

No. 31 **Distance in a closed Circuit** (*U.S.A.*)
"Stretcher" by Maynard L. Hill, 1 motor Merco 0,49 at Layhill (Maryland), June 4th, 1965 ... 280 km.

R/C GLIDERS

Class F-3B to D

No. 24 **Duration** (*South Africa*)
G. Brooke-Smith at Tygerberg Hills, Cape Town, on November 14th, 1965 ... ... 11h. 33m. 28s.

No. 25 **Distance in a straight line** (*U.S.S.R.*)
N. Malikov, May 17th, 1965, Toula to Kalmyki ... 16.725 km.

No. 26 **Height** (*U.S.A.*)
M. Hill, July 23rd, 1966 ... 1,116 m.

No. 34 **Distance in a closed Circuit** (*U.S.A.*)
F. Colver at Irvine Ranch (California) on May 8th, 1965 ... 70.1 km.

Speed (*U.S.A.*)
Strong/Hahn ... ... 93.342 km/h.

PROPS AND POWER

Free Flight help from "Airfoil" Newsletter

Effect of Diameter on Thrust

ENGINE tests on the G15 give a peak power of 0·605 b.h.p. at 22,000 r.p.m. The engine power curve is given in Fig. 1, and also shows the power absorption curves for Tornado 8 × 4, Topflite 8 × 4 and 7 × 4. The propeller curves are averaged values obtained from *Aeromodeller* tests over the last six years. The point at which the engine power curve crosses a particular propeller power curve gives the static r.p.m. The values given of 16,800 r.p.m. on the Tornado 8 × 4, 17,200 r.p.m. on the Topflite 8 × 4 and 21,300 r.p.m. on the Topflite 7 × 4 agree closely with figures quoted elsewhere on these propellers.

As the G15 peaks at such high r.p.m., it is being held back by the commercial 8 × 4 props and only develops 0·51 b.h.p. at 17,200 r.p.m. whilst on the 7 × 4 prop 0·600 b.h.p. is available. The variation of thrust with forward speed for 7 in. and 8 in. diameter propellers is shown in Fig. 2 using these power figures. No allowance is made for r.p.m. increase in the air, but if included, would improve the 8 in. prop relative to the 7 in. prop. The curves show the 7 in. prop to produce greater thrust at all speeds as the additional power available more than offsets the reduced prop efficiency.

Modified versions of commercial 8 × 4 nylon props can be turned up to 19,500 r.p.m. and similar figures have been obtained on wooden 8 × 3½ in. This corresponds to 0·57 b.h.p. and using this power, a third curve is given in Fig. 2 for an 8 in. prop. More thrust is produced at all speeds by this combination although at high speeds the gains over the 7 in. prop are small. As height gained under power depends upon both acceleration and top speed, the larger diameter prop is definitely favoured, provided near peak r.p.m. can be achieved.

Gearing and Propellers

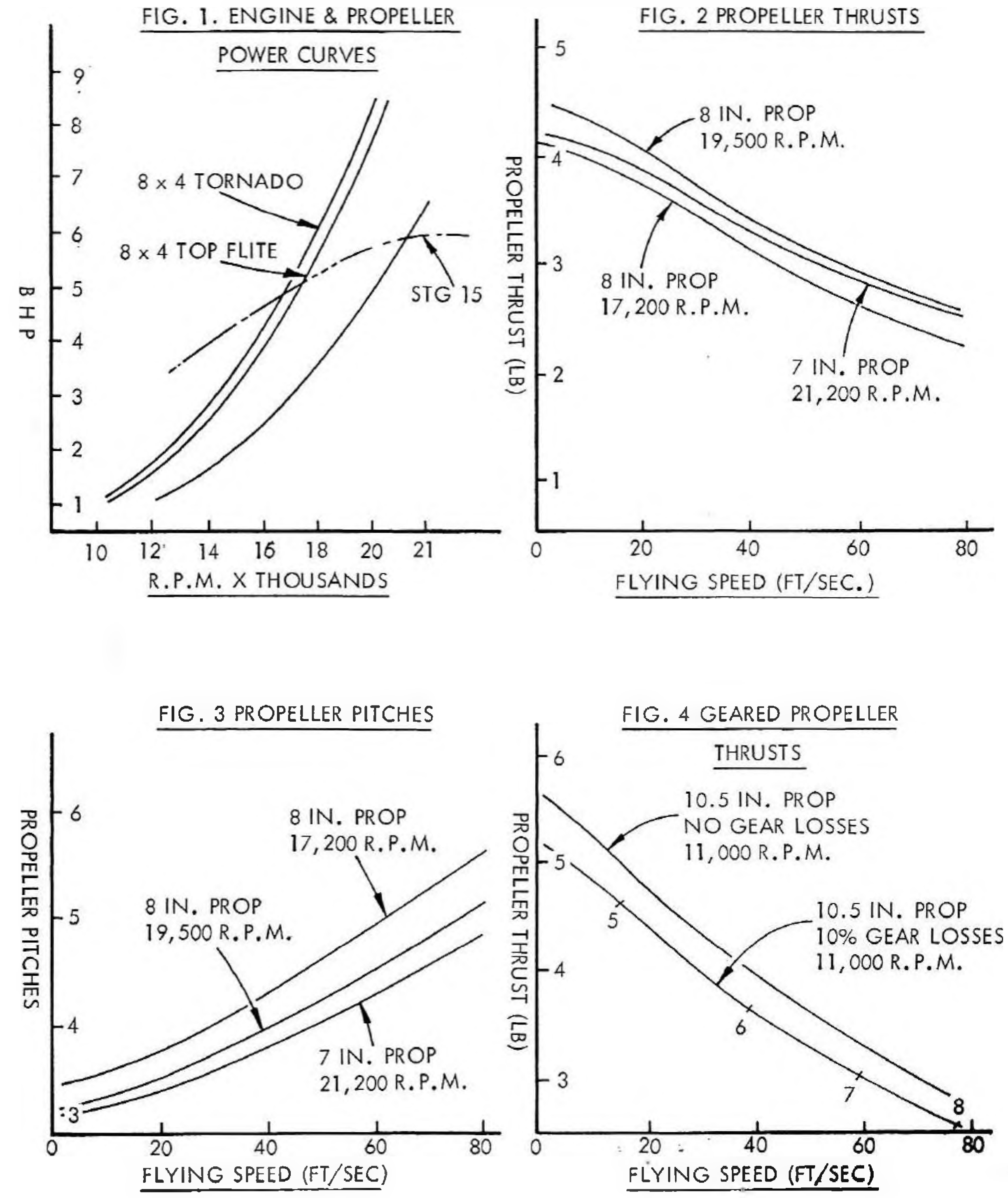
Discussions indicate the difficulties of matching a high revving engine with propellers of reasonable efficiency. Gearing down the shaft r.p.m. increases the torque available and permits larger diameter propellers to be turned with consequent improvements in prop efficiency. The gear box introduces additional power losses which must be kept low if worthwhile improvements in thrust are to be obtained. In practice it is unlikely that gear losses could be kept below 10% of transmitted power because of the high r.p.m. and the difficulties of manufacture and alignment in model sizes.

Gearing was used successfully in the 0·02 cu in. Clipper Cargo class several years ago. This class was very responsive to such developments as:

(1) low flying speeds were used to give maximum rates of climb on the limited power available.

(2) commercial props were of very low efficiency due to the small diameters and unduly thick blade sections dictated by manufacturing requirements.

PROPS & POWER CHART



Using single bladed props in addition to gearing permitted diameters to be doubled and the performance improvements were dramatic. To indicate the improvements from gearing, the thrust curves for 10·5 in. diameter propellers are given in Fig. 4, assuming that a 2:1 geared down ST G15 supplies 0·6 b.h.p. at 11,000 r.p.m. Curves are given for (1) no gear losses and (2) 10% gear losses, showing the considerable penalty gear losses incur at higher speeds. Comparing the best 8 in. prop curve, Fig. 2, with the 10·5 in. prop with 10% losses, shows the larger prop to be 13% better statically, *falling* to 2% better at 60 ft./sec.!

Selection of Blade Planform

To keep prop efficiency high the thrust distribution over the propeller must be near uniform. It can be shown using simple theory that the blade planform giving uniform thrust distribution tapers towards the tip and is part of a hyperbola.

A reasonable practical approximation to this shape makes the tip chord half the chord at the axis of rotation, and uses an elliptic tip over the outer 10-15% of radius. It is interesting to note that full size tilt-wing aircraft, *e.g.*, XC 142, have flown using this type of blade shape.

To maximise diameter, blade aspect ratio should be as high as permitted by the structural integrity of the blade. It is important to keep blade thickness low (10-12%) particularly towards the tips. The combination of high r.p.m. and large diameters produce tip "Mach" numbers high enough to give drag rose effects, if thick sections are used.

Finally

The foregoing treatment of propeller theory, although simplified, provides the following pointers:

(1) Turn the largest diameter propeller consistent with achieving near peak power in the air.
(2) Use blade planforms tapering towards the tip—they give a favourable thrust distribution and are good from a structural viewpoint.
(3) Blade section thicknesses should be kept low, particularly towards the tips.
(4) Gearing down the motor is attractive if flying speeds are low/medium and provided gear losses can be kept low.

It would be a useful check on the assumptions made in the propeller theory to have static thrust data on engine/propeller combinations. Enthusiasm and F.A.I. trials permitting, it was hoped to do some measurements in '67—if any other modeller has made such tests already and would make the information available, it would be received with interest.

UNION THREADS

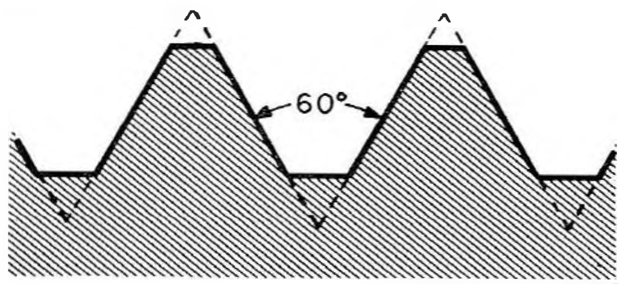
by A. A. C. Jordan

MY research into American screw threads began when I bought a KB ·45 for 2/6! It had been pranged in a control line job and the crankcase was distorted along the cylinder axis, so the shaft would not turn over; I was urged into buying on the ground that it was useful for spares, and the plug alone was worth more than half a crown anyway. But in the end, the idea of cannibalisation did not appeal and I decided to rebuild; an R/C crankcase was coaxed out of a pen friend in the States, and various part of the throttle unit were turned up at an evening class. Then came the problem of tapping for the KB spray-bar—no doubt I could have bought a new throttle unit quite easily, but my creative interest, and my lack of funds stopped this.

My experience of American threads was practically nil; it amounted to the fact that many sizes were close enough to British standards to accept a nut for half a turn and no more. Advertisements and articles in U.S. magazines produced such information as 2-56, 4-40, 8-32, *etc.*, but the local tool shop simply said "All non-standard sizes; no can do". When it was pointed out that ¼-28 is in world-wide use for glow and spark plugs, they replied scornfully that it was still not standard, ¼-32 is Model Engineer standard, and the only American taps and dies they might have were the larger sizes used in the motor trade. Frustrated in this way, I pursued the enquiries and these results came out.

The American threads are made to the Unified National system in fine or coarse, known as U.N.F. or U.N.C. The thread form differs from British standards in being flattened at the crests and roots instead of rounded, and the pitch angle is 60°, against 55° for Whitworth and 47½° for B.A. The American aircraft industry has adopted a series of extra fine threads, probably due to the coarser nuts tending to slack off under vibration.

The more common sizes are:

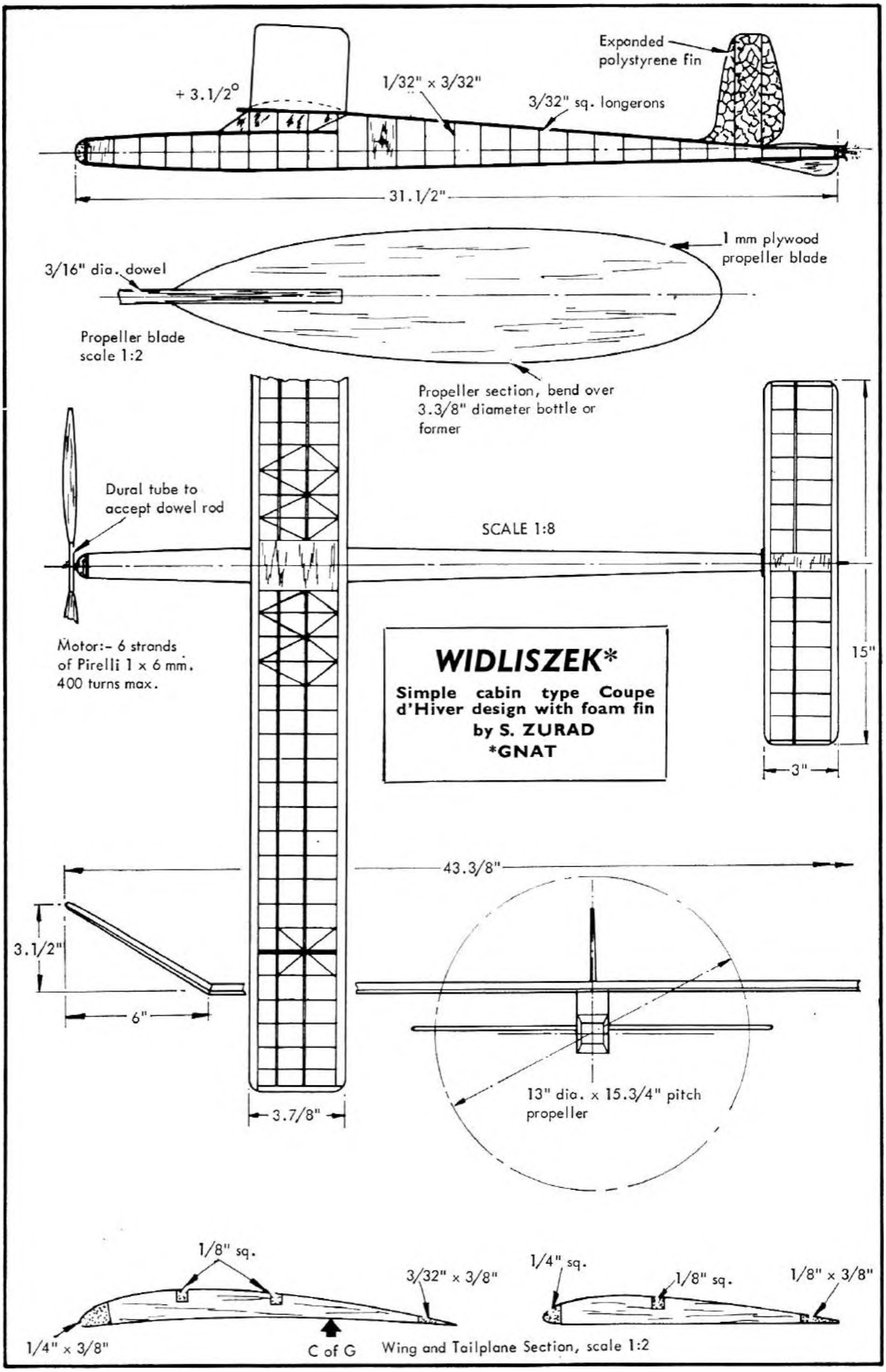


NUMBER	DIAMETER IN INS.	THREADS COARSE	PER INCH FINE	DRILL TAP	SIZE: CLEAR
2	·0860	56	64	51	48
3	·0990	48	56	46	38
4	·1120	40	48	43	33
6	·1380	32	40	34	28
8	·1640	32	36	29	19
10	·1900	24	32	25 coarse 21 fine	11
¼″	·2500	20	28	8 coarse 3 fine	¼″

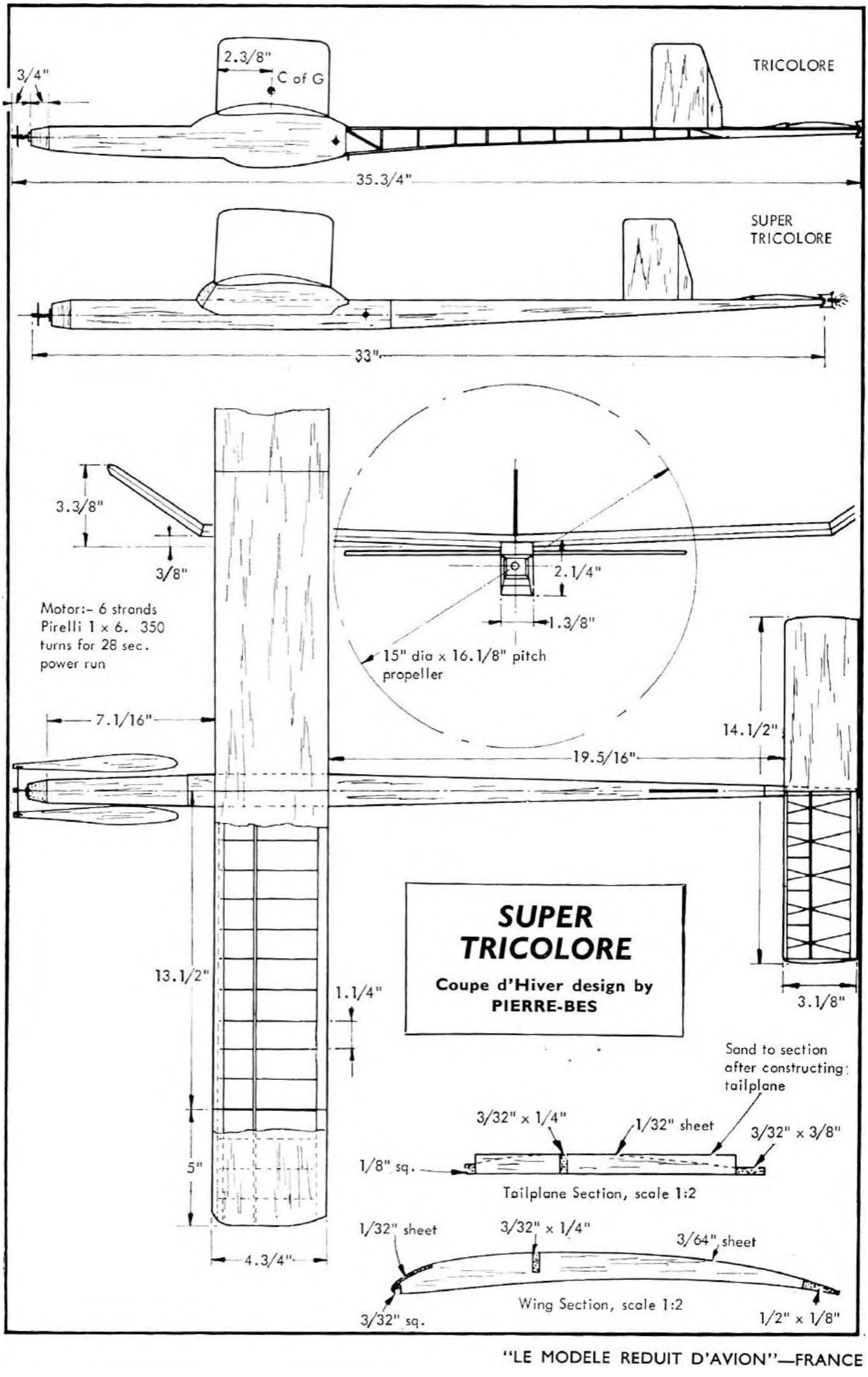
Only one size of tapping drill is quoted for Nos. 2 to 8 in the interest of economy; strictly speaking there is a difference for coarse or fine tapping sizes —more detailed information can be obtained from engineering data tables.

After all that, how does one get the taps and dies? An approach was made direct to a manufacturer, and after some misunderstandings on both sides (one quote for a tap was £4! My letter was not sufficiently precise, and they misread it and quoted for a hand-made left-hand thread tap). I got most of the sizes needed. The best way seems to be an order to your local tool shop asking them to order through Buck & Hickman if not in stock already. Usual disclaimer—I have no connection with B. & H. who are one of the biggest wholesale tool suppliers in the country. They will not supply individuals direct and although very helpful when approached, they very firmly referred me to my normal supplier.

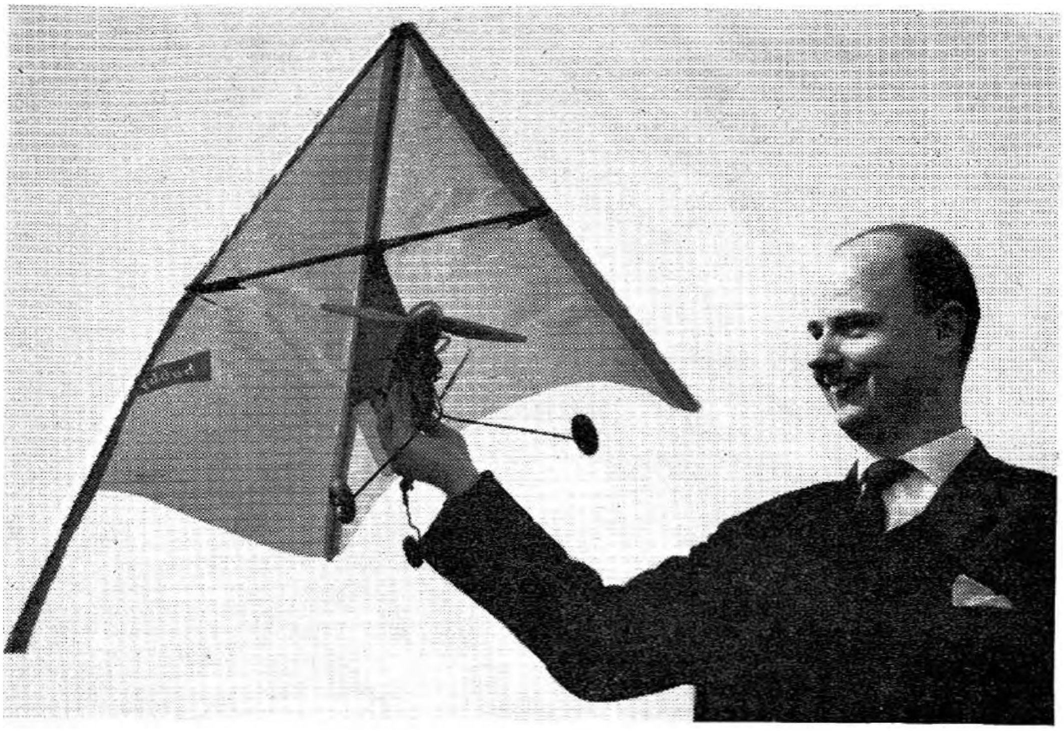
Tail-piece—after all the effort, the KB spray-bar turned out to be threaded 8-40! Happily, B. & H. located the necessary tap.



"SKRZYDLATA POLSKA"—POLAND



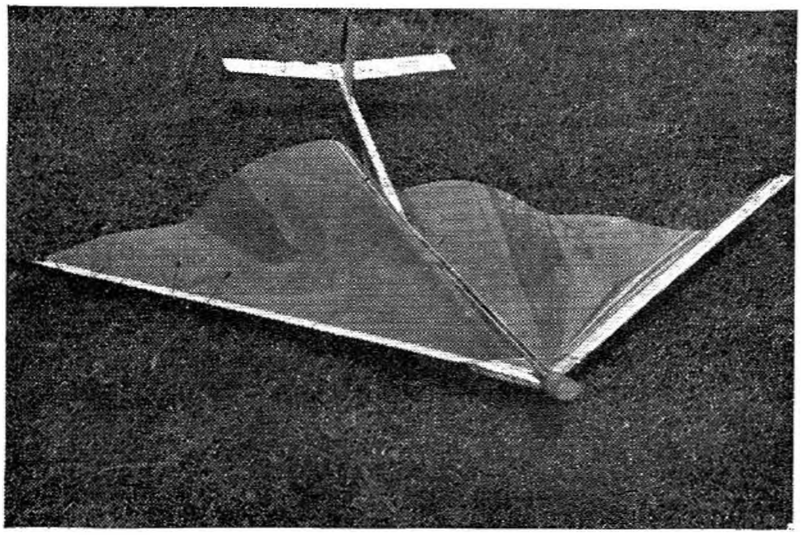
"LE MODELE REDUIT D'AVION"—FRANCE



FLEXWING FLYING MODELS

As most of us know, the flexwing concept was originated by F. M. Rogallo from the N.A.S.A. after considerable study of kite flight. The main idea is in having a comparatively simple and cheap lifting surface capable of carrying big payloads and flying fully controlled. Ryan Aircraft Corp. in the U.S.A. also did a considerable amount of research in this field and the flexwing is now slated to bring the Gemini spacecraft down from orbit. All these vehicles were controlled up to now by shifting the centre of gravity, this being done by movement of the payload. This problem of controlling is quite interesting and I decided to build several flying models employing conventional controls (rudder and elevator) for control-line.

The first was a small (20 in. span) model which did not do much except prove that a dihedral helps lateral stability (and in the case of a flexwing this really was not so obvious as it seems). The next model was already more



Heading shows well known German aviation writer Erich Heimann with a flexwing model.

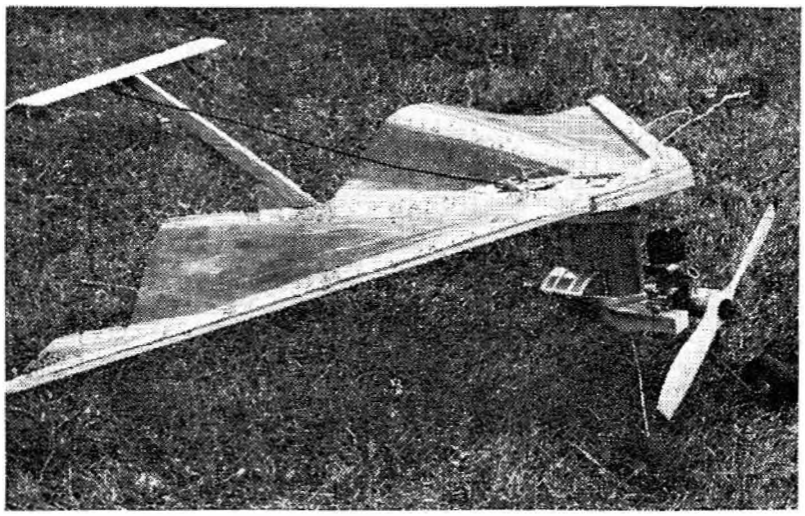
Left: Fig 1. Second model built. Span 4¼ ft. wing area of 5½ sq. ft. Mylar wing material. Flown as a glider and showed the way to further experiments.

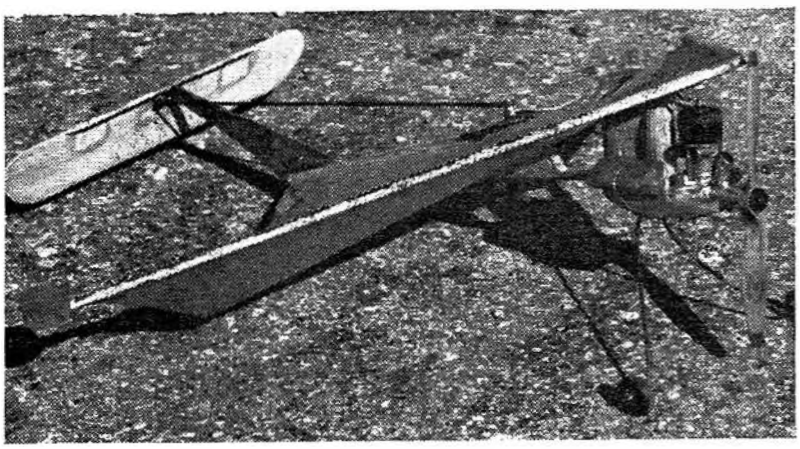
ambitious (Fig. 1). Span was 4·25 ft., with a wing area of 5·5 sq. ft. All the construction, except for the tail and tail boom, was of hardwood and the wing material was 0·003 inch thick "Mylar". Tail surfaces were from $\frac{1}{16}$ in. balsa with metal trim tabs and the tail boom was of a box construction. Nose angle was 100° and the mylar when spread flat was 110°. (Nose angle has extreme influence on longitudinal stability in all flexwing designs.) There was a small dihedral, with the wing tips about 3 inches higher than the centre beam and a small tab on the right tab provided trim. It was launched with the regulation 50 metre line and performed excellently. During the launch it sometimes tended to turn but in a later model this was rectified by building a small skid under the wing and attaching the launching hooks to it. (Originally the hooks were attached directly to the centre beam.)

The next step was obviously a powered model. Since I am interested mostly in the control effectiveness problem the natural choice was the control line model (Fig. 2). Span is 38 in. Nose angle 100°. Covered with 0·005 Mylar. Engine: McCoy 35. Construction entirely of hardwood and plywood. It was flown with 9/7 Tornado and 10/4 and 10/6 Top Flite props and clocked 55 m.p.h. with the 10/6. All take-offs were from the ground and after the engine stopped it was executing perfect three point landings under full control. Engine was offset some 3° but this definitely was not enough as I found later in the usual manner (during a loop).

After these followed a series of four models which were built in quick succession (two powered and two gliders) in order to test various points in construction and aerodynamics. Nothing really spectacular until the next, seen

Right: Fig. 2. A control line flexwing. Span 38 in., powered with McCoy 35. Mylar covering. Hardwood and balsa construction. Flew both under power and with engine stopped.





Left: Fig. 3. Another control model built five models later. This was designed for aerobatics, which it did perfectly including inverted flight. Span 30 in. McCoy 35.

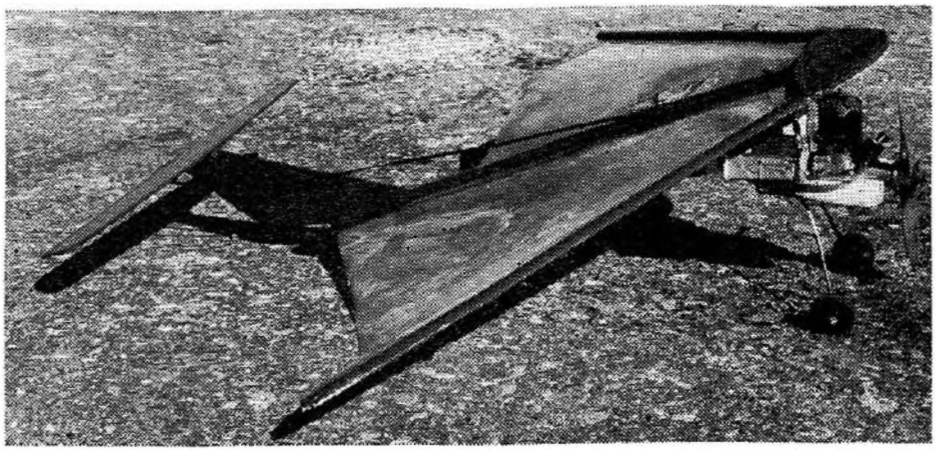


Fig. 4. Built by a friend of the author's on similar lines. Power O.S. Max 35.

in Fig. 3. It was designed with aerobatics in mind which it did beautifully, including inverted flight. Its span is 30 in. with nose angle of 100° and spread cover of 106°. Flies best with a 10/4 wood prop and the engine (again a McCoy 35) offset 10°. Cover is again mylar but that is simply because I have no better better use for my stock (and several models were flown already with different materials). Its most important feature I believe is that total building time is less than seven hours and in the case of a major crack-up it usually takes no more than two hours to repair it.

The model in Fig. 4 was built by a friend of mine along the same lines. Powered by an O.S. Max 35 it also performs excellently. The model in Fig. 5 was a try at the free flight field. Powered by a 1·5 c.c. Webra diesel it flew . . . after a fashion. Its only redeeming feature and the reason I mention it at all is that the cover was made from an old nylon table cloth.

In all these models very little attention was paid to a nice finish. I was more interested in getting simple, rugged and quickly built models. Results are definitely encouraging and I plan to continue. I doubt whether a flexwing will ever compete with conventional sailplane models or break any speed records but they can be built as very handy and sturdy stunt ships. What is more, they can be built in ridiculously short time, take tremendous beating and if broken repaired in no time at all (and I speak from experience). Either for beginners or for keeping your hand in practice they are definitely the answer for that old problem: a cheap, simple and reliable stunt plane.

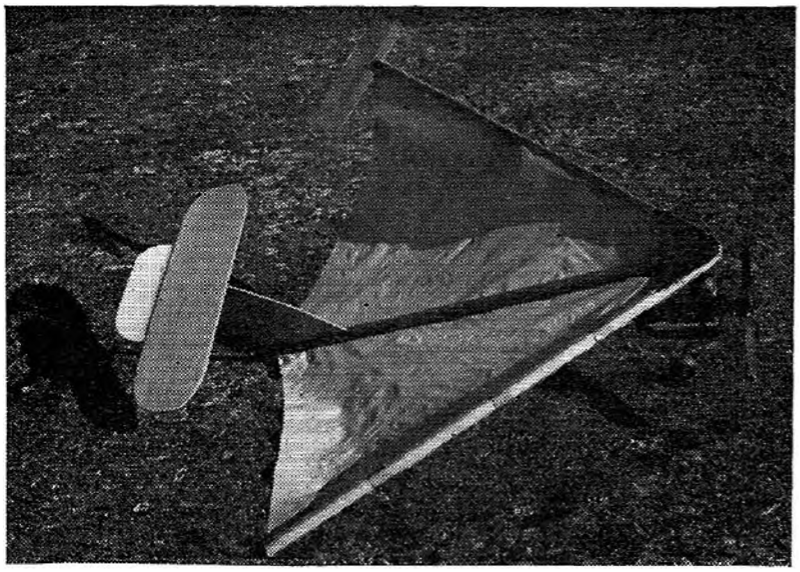
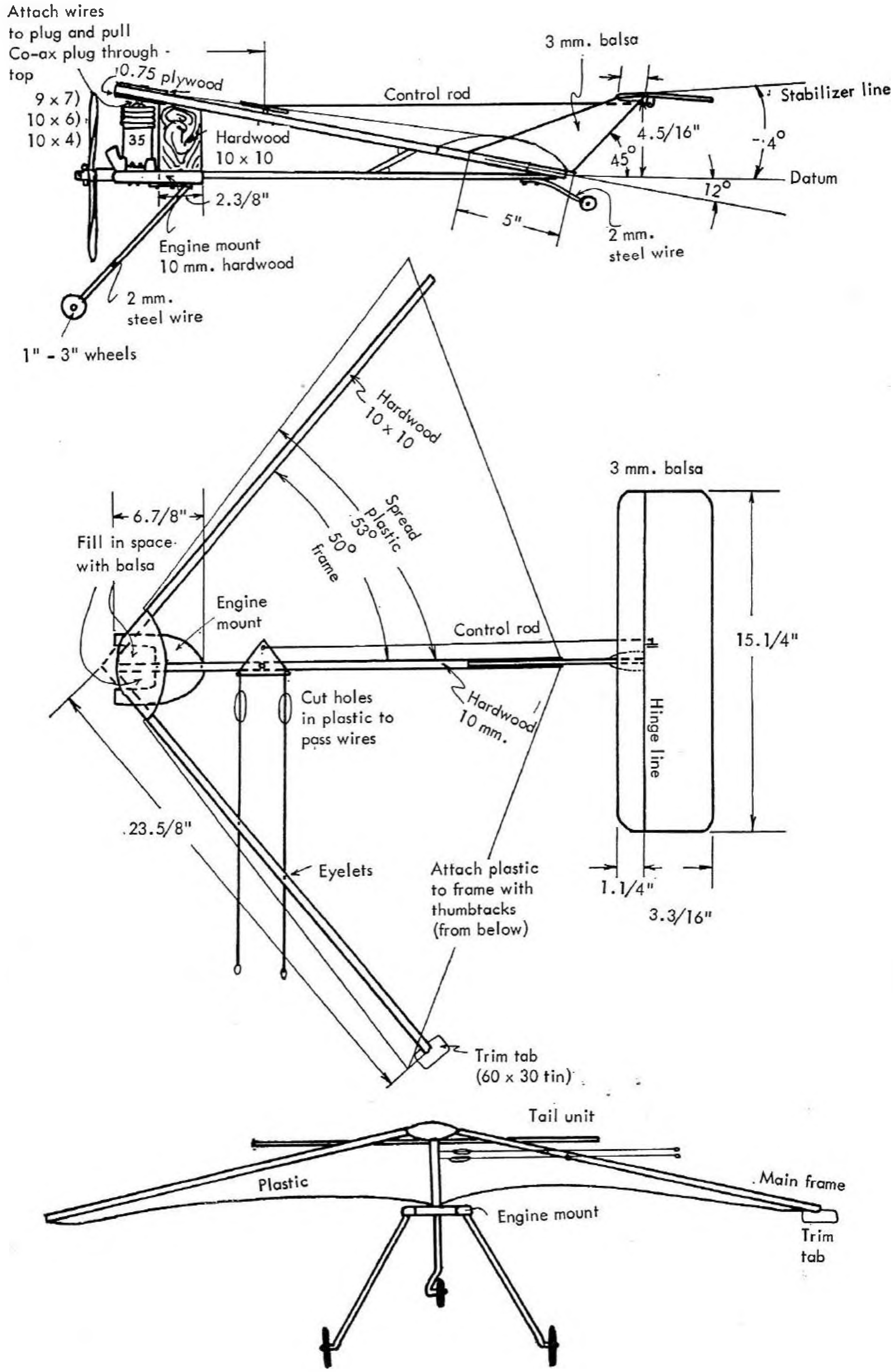
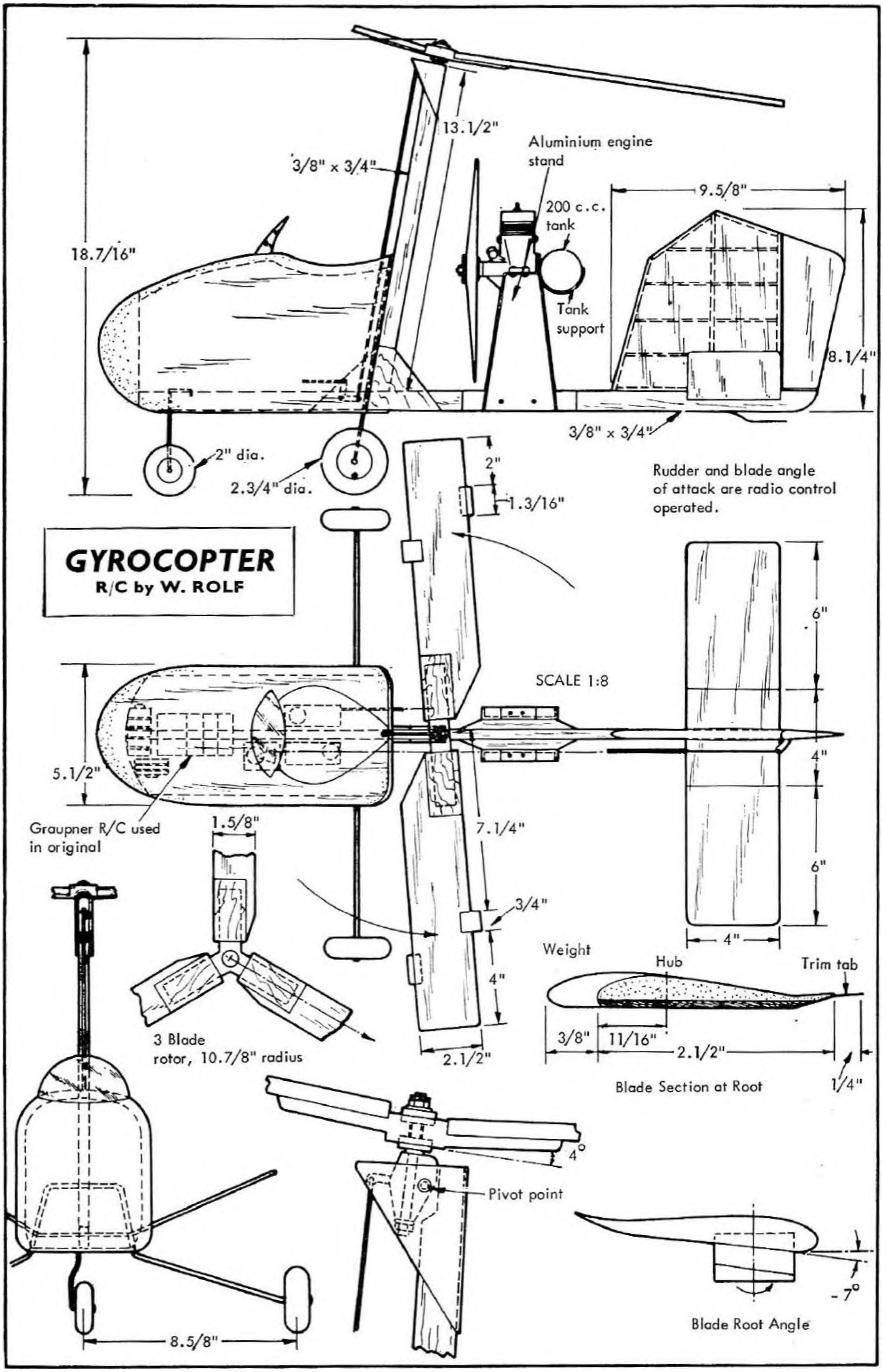
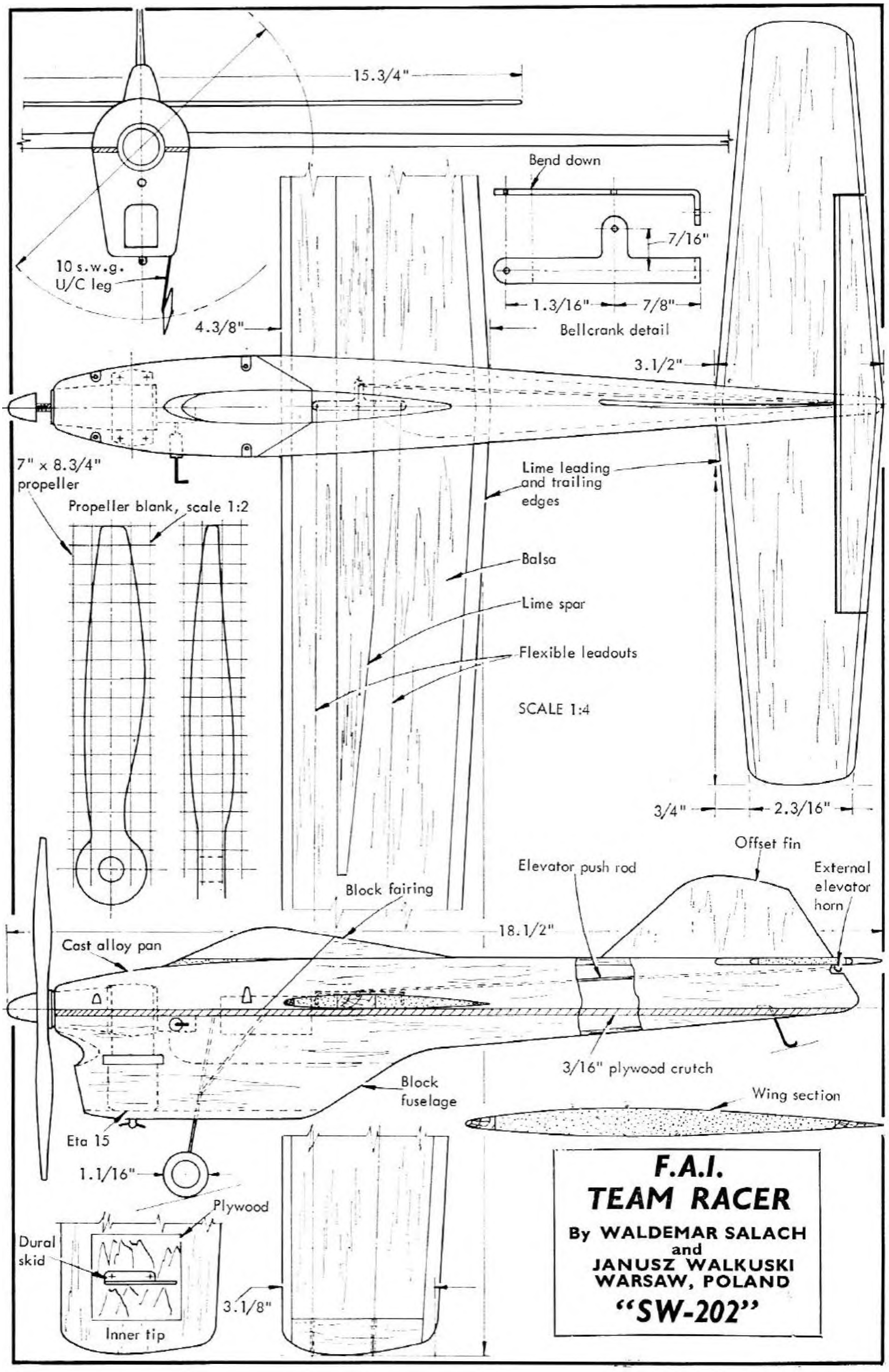


Fig. 5. A free flight model. Webra 1·5 c.c. Covered with an old nylon tablecloth . . . almost its only claim to fame!

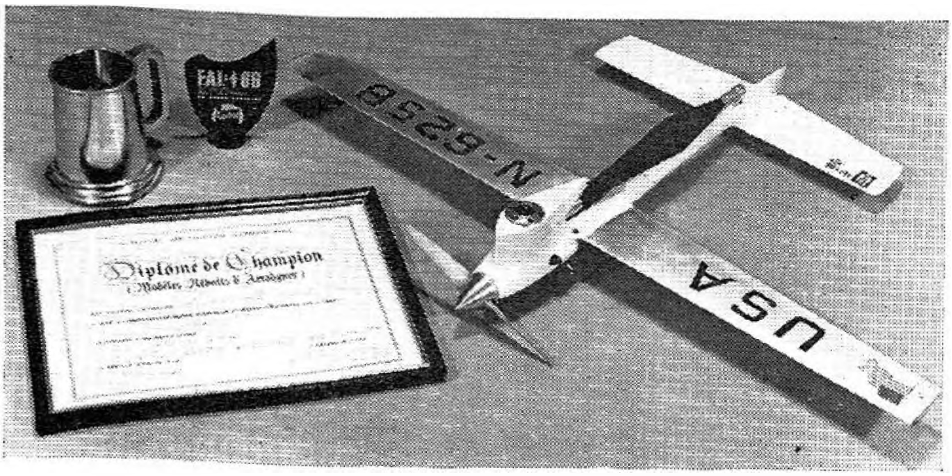

Attach wires to plug and pull Co-ax plug through top
0.75 plywood
9 x 7)
10 x 6)
10 x 4)
35
Hardwood 10 x 10
Control rod
3 mm. balsa
Stabilizer line
4.5/16"
45°
4°
Datum
12°
2.3/8"
5"
2 mm. steel wire
Engine mount 10 mm. hardwood
2 mm. steel wire
1" - 3" wheels
Hardwood 10 x 10
3 mm. balsa
6.7/8"
Fill in space with balsa
Spread plastic 53°
50° frame
Engine mount
Control rod
15.1/4"
Cut holes in plastic to pass wires
Hardwood 10 mm.
Hinge line
23.5/8"
Eyelets
Attach plastic to frame with thumbtacks (from below)
1.1/4"
3.3/16"
Trim tab (60 x 30 tin)
Tail unit
Plastic
Main frame
Engine mount
Trim tab



"FLUG & MODELLTECHNIK"—W. GERMANY



SKRZYDLATA POLSKA, POLAND



The author's record-breaking FAI speed model; FAI Diploma; S.M.A.E. Trophy and Tankard Memento, fruits of his flights at 1966 World Championships in England.

TUNED EXHAUST PIPES

By Bill Wisniewski

(*reproduced by permission from "Model Airplane News", U.S.A.*)

For many years we have been tuning the exhaust gases in a miniature two-stroke engine to produce an increase in power and speed as well as effectively decrease the noise level. I hope that the information in this article can help further the interest in speed as well as other events that put an emphasis on speed and power.

When done properly, a tuned exhaust pipe can not only produce at least 10% increase in power output, but also will make an excellent muffler, reducing the noise level by approximately 40%. This silencing action could bring back some of the lost flying fields and the power increases could make the silencer a popular item.

I have been working on exhaust tuning with Roger Theobald for the past five years. The initial experiments were prompted by conversations with Jack Smith, a motor-cycle enthusiast and an old time model airplane enthusiast and were, therefore, patterned along motorcycle practice.

We have quite a few problems along the road to success starting from those experiments. The first bench tests showed an immediate improvement so they were encouraging. However, we were unable to realise this gain in flight.

Progress was slow after these tests, but during late 1965 and 1966, prior to the Control Line World Championships in England, work in this direction was accelerated. Progress was made in two directions: first in improving the dimensions of the exhaust pipe and, second, in developing a technique which would let us realise the bench test potential in flight.

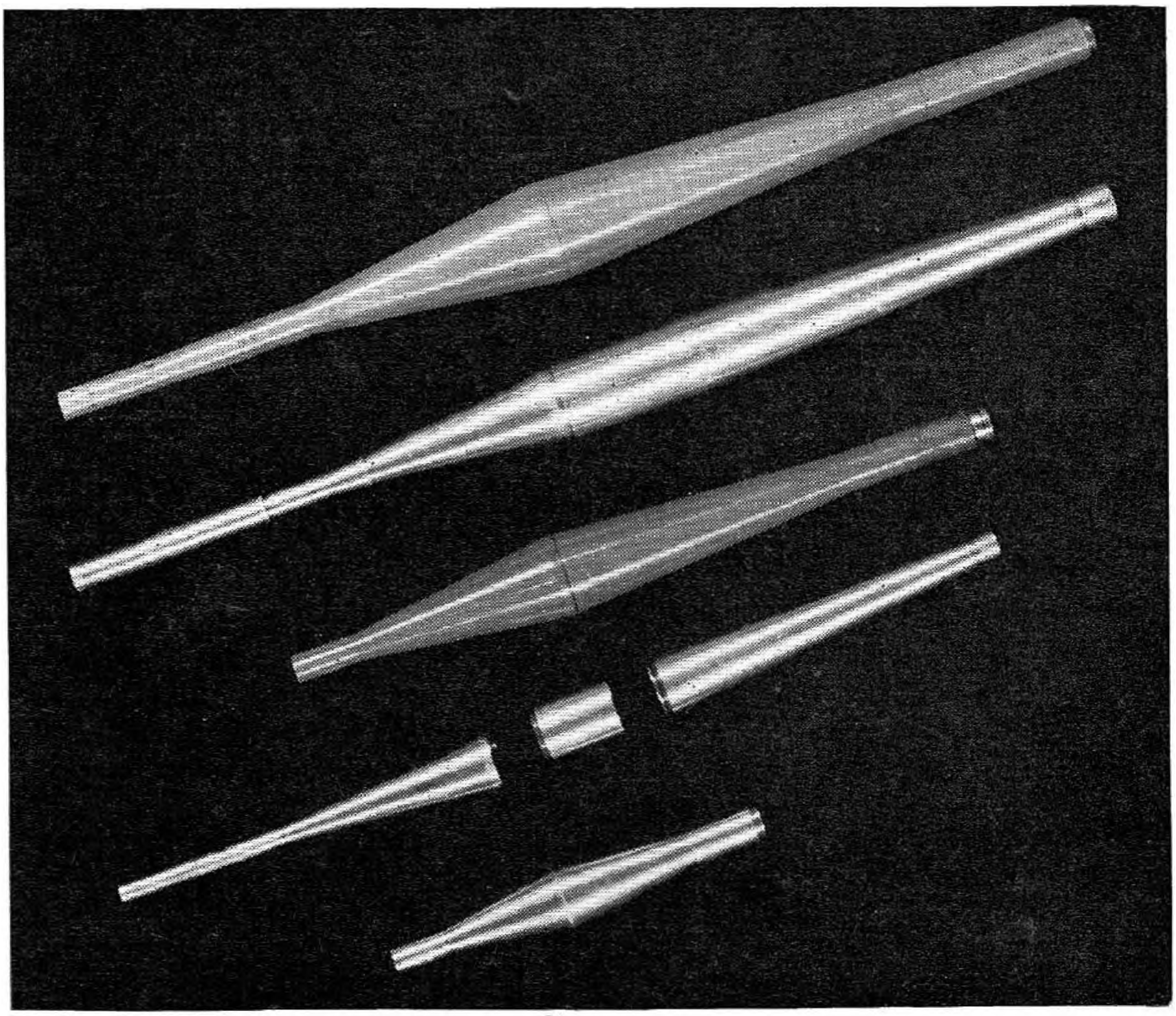
The dimensions of the first pipes were taken using a typical motor-cycle proportions and scaling the length to model engine r.p.m. by using the exhaust gas wave velocity corresponding to petrol. These figures were found to be considerably higher than the correct one for alcohol. In addition to the difference in fuel, model engine fuel is much higher in oil content than that used in motor-cycles which also adds mass to the exhaust gas.

By trial and error and with the help of thermocouple equipment, we were able to measure the temperature along with the length of a fairly successful pipe and estimate the average velocity for our engines. It was determined that the temperature is quite high (as high as 750° F.) and because of this, the exhaust pipe was insulated from the engine.

This insulation is a silicone rubber coupling and is constructed by casting General Electric RTV-90 compound in plastic mold which has been machined to the same dimensions as the end of the pipe. The RTV-90 coupling is bonded to the pipe by priming it with G.E. ss4004. Without this treatment, the coupling will not adhere to the metal.

The temperature measurements and the lack of success in flight tests led us to suspect that the pipe was cooling off a great deal in the air and reducing the temperature of the exhaust gases. The reduced temperature reduces the wave velocity in the exhaust and effectively makes the pipe too long. The pipe was insulated with silicone rubber and this modification was fairly successful. The F.A.I. model jumped in speed from low 140's to 150 m.p.h. Experiments with various coatings continued until the presently used black Sperex VHT exhaust paint was tried. This coating resulted in the largest improvement in efficiency

Selection of early tuned exhaust pipes: top two pipes are for a ·60 engine. Third one down is first successful ·15 engine pipe. Then comes first ·15 pipe with centre section. Several such centre sections of different lengths were made. At the bottom: an unsuccessful pipe.



and resulted in speeds around 160 m.p.h. with the F.A.I. model on the standard 80-20 fuel (*i.e.*, no nitro).

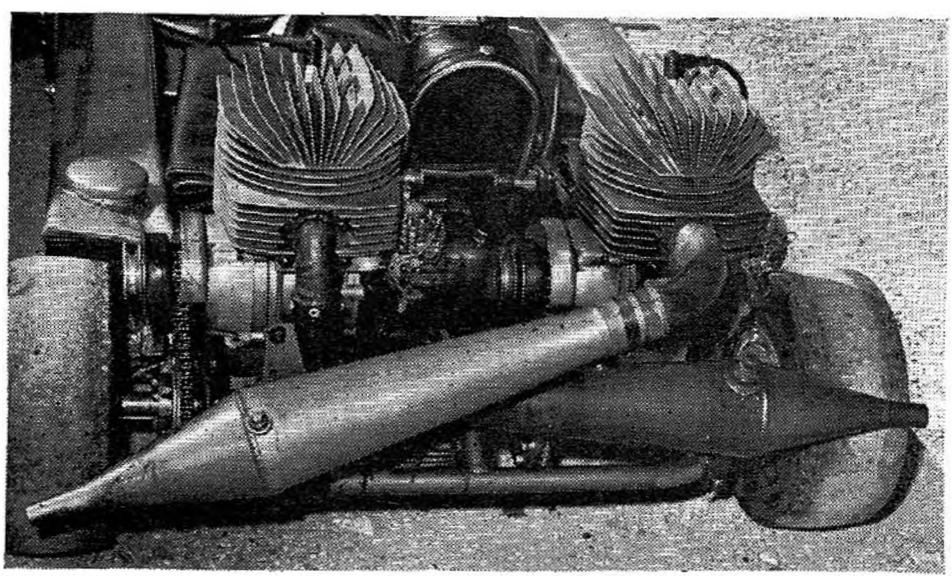
A few words on the principle of exhaust tuning are in order. The engine, on the intake compression stroke pulls air and fuel into the crankcase and also compresses the fuel and air in the cylinder. The power and exhaust stroke is the next. This is where we make use of the hot outgoing gases to scavenge the cylinder and pull the excess fuel and air in the crankcase through the engine, fill the cylinder and pull part of the mixture into the headpipe of the exhaust system. Then the pressure builds up in the pipe sending back a positive pressure just as the transfer port closes and the exhaust port is still open, thus, pushing the mixture in the headpipe back into the engine under positive pressure giving a supercharging effect.

Now that the principle is known, we will have to design a pipe for an engine. First we must measure the volume in the crankcase with the piston at bottom centre. From practical experience, I have found that the internal volume of the pipe should be about ten times the crankcase volume and the headpipe cross sectional area should be 1·6 times the exhaust port area. The next step is to find the length of the exhaust system excluding the tailpipe length. This is done by picking a useful r.p.m. This must be converted into time. To make it less complicated take the r.p.m. and reduce it to revolutions per second (c.p.s.) by dividing r.p.m. by 60 then divide c.p.s. into 1, *i.e.* $\frac{1}{\text{cps}}$ to get the amount of time for one cycle.

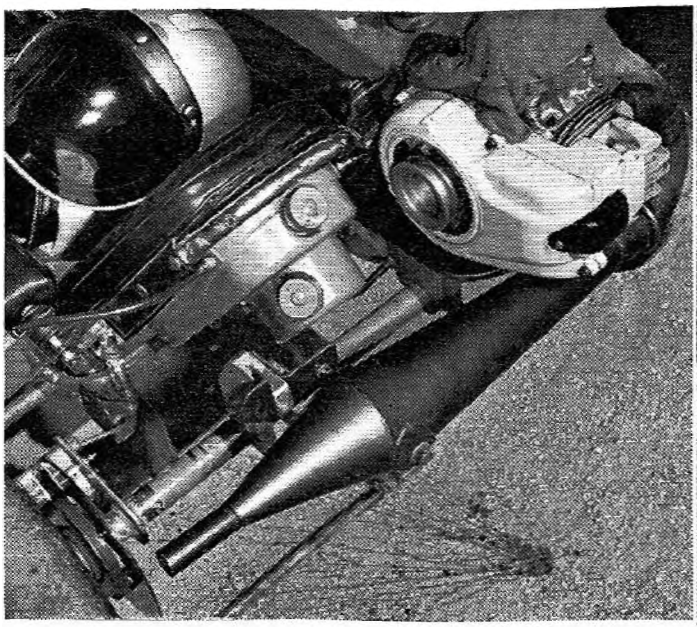
Then we must figure the percentage of exhaust opening less the overlap or difference between the exhaust and transfer ports on the upstroke. For example, if an engine has 170° exhaust opening and 130° transfer opening we have 40° difference total then divided by two is 20°.

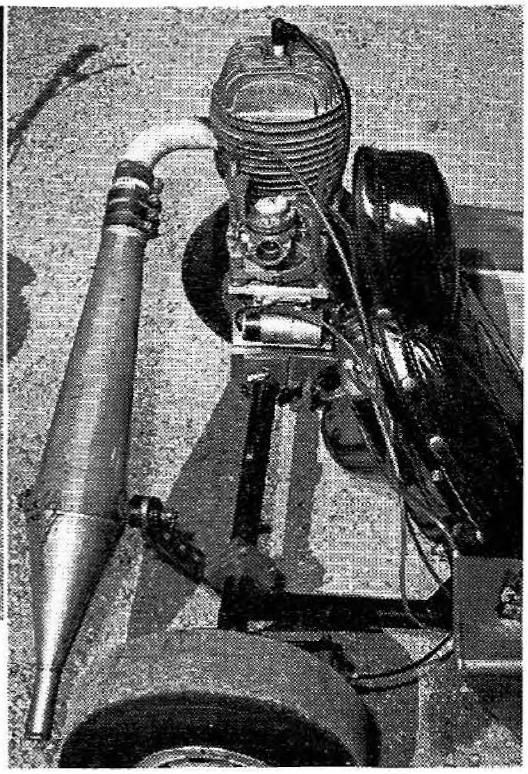
170°—20°=150°. Then divided by 360° will give us the required percentage. Let's call this number in the formula (*P*). Now we must use a constant which is the speed of sound at the average exhaust temperature in inches per second. Practical experience has come up with 22000 in./sec. for our constant.

Then to reduce this to half wave divide by 2 so the formula resolves



American go-kart tuned exhaust arrangement — this time for two motors, involving some careful packing.





Still further go-kart treatments. Reduction in noise nuisance for the comfort of nearby residents also paid dividends in increased performance.

itself to

$$L=\frac{\frac{1}{\text{cps}}\times P\times 22000}{2}$$

For proportions see Fig. 1.

These proportions are derived from experience also.

The tailpipe cross section area is $\frac{1}{3}$ the cross section area of the head-pipe and the length is the intersection of the convergent cone plus one diameter of the tailpipe.

Now to the engine. It must have no sub-piston induction, that is, at top centre there should be no gap showing under the piston. The reason for this is that the pipe creates such a violent negative wave just after the exhaust opens that at top centre you are pulling some of the crankcase charge into the pipe which leaves you with a very weak mixture in the crankcase with a decrease in power rather than an increase. Also, the more the difference between the port heights on transfer and exhaust, the more range of r.p.m. you have. For example, 5° overlap=1000 r.p.m. range.

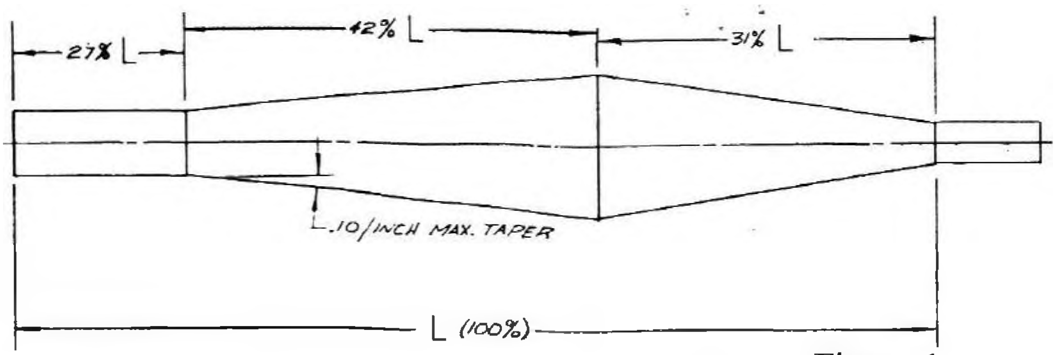


Figure 1.

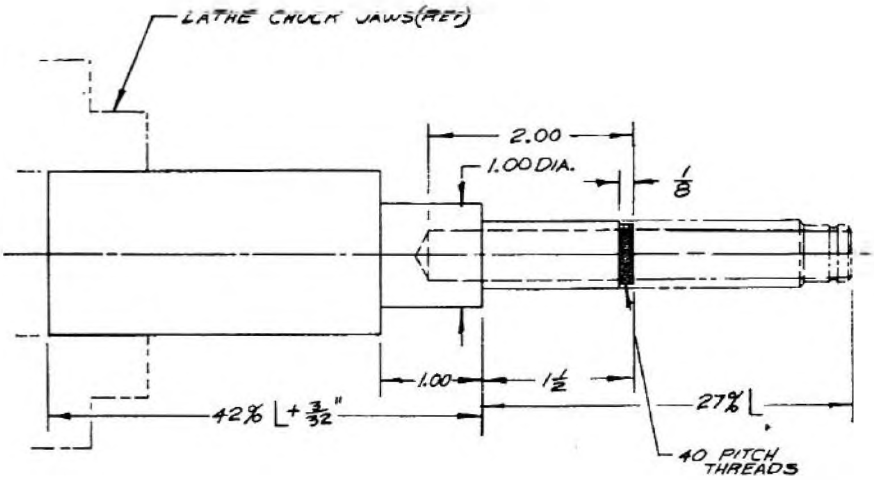


Figure 2.

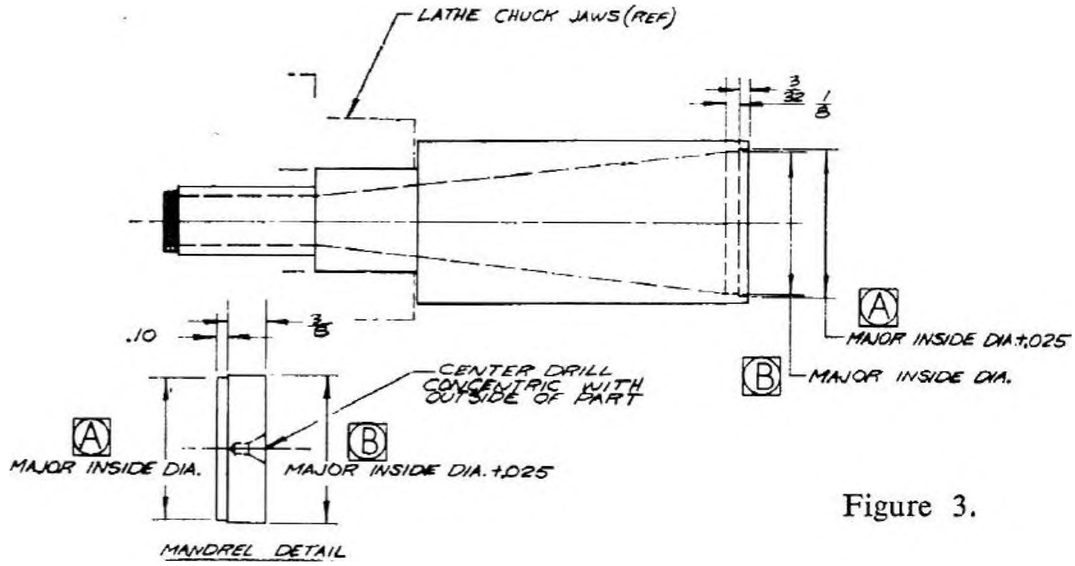
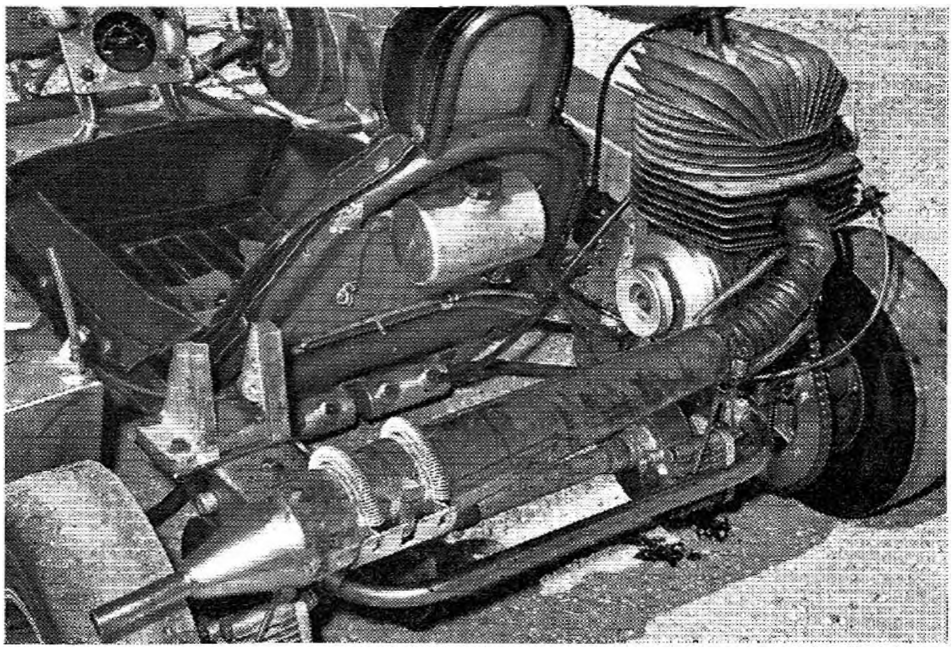
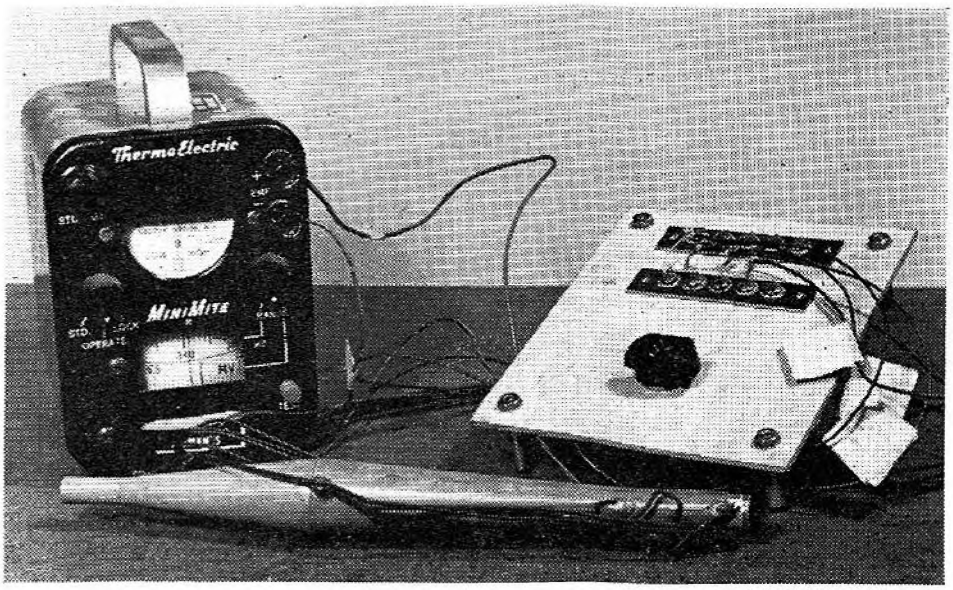


Figure 3.



Typical pipe fitted to go-kart. Experiments with motorcycle engines were the foundations on which model aeroplane engine techniques were developed.

Photographs by courtesy of "Rod & Custom" U.S.A.



Tuned exhaust with thermo - couple leads. Thermocouple instrument and selector switch which proved so valuable also appears in the photograph.

Construction of the pipe is not too difficult, but it is time consuming. All the pipes used were machined from aluminium and magnesium bar stock. A taper attachment for the lathe is handy, but not essential. Here are the steps we followed.

1. Bore the inside diameter of the headpipe to about 2 inches deep. Turn the outside diameter of the headpipe $1\frac{1}{2}$ in. length. Thread the end of $\frac{1}{2}$ inch. We used a forty pitch thread on the headpipe so that extensions can be made for varying conditions. Then turn a 1 inch diameter $\times$ 1 inch length. Face to $42\%\ L + \frac{3}{32}$ inch. (See Fig. 2.)

2. Reverse part hold on 1 inch diameter and bore press fit diameter for mating part $\frac{3}{32}$ inch deep. Bore major inside diameter $\frac{1}{8}$ in. deeper than press fit diameter. Set taper with a dial indicator. Bore taper blending at major inside diameter. (See Fig. 3.)

3. Make a plug to fit the major inside diameter of pipe as shown in Fig. 3. Hold on the headpipe with the plug in the end supported by a live centre. Turn the outside taper to a 0·016 wall thickness. Then turn the major outside diameter to major inside diameter plus 0·050. Blend outside taper to the headpipe. (See Fig. 4.)

4. Make rear cone using the same procedure as the front cone except as shown in Fig. 5.

5. Bond the two cones together using a good high temperature adhesive at the press fit joint.

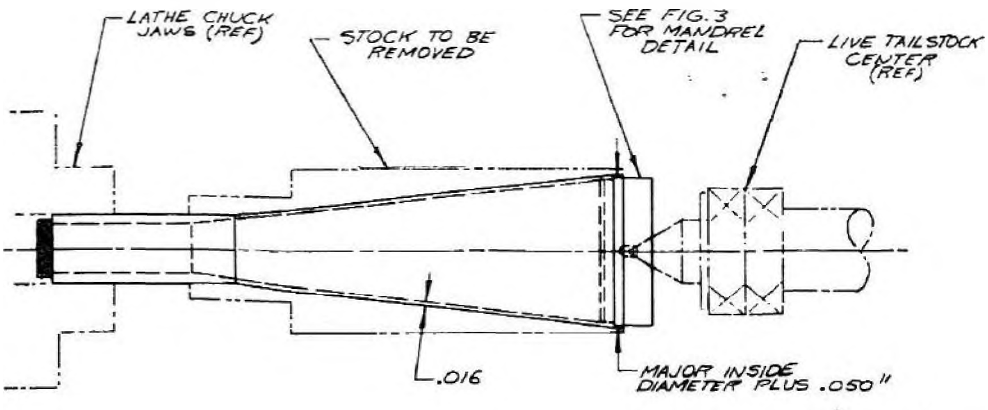
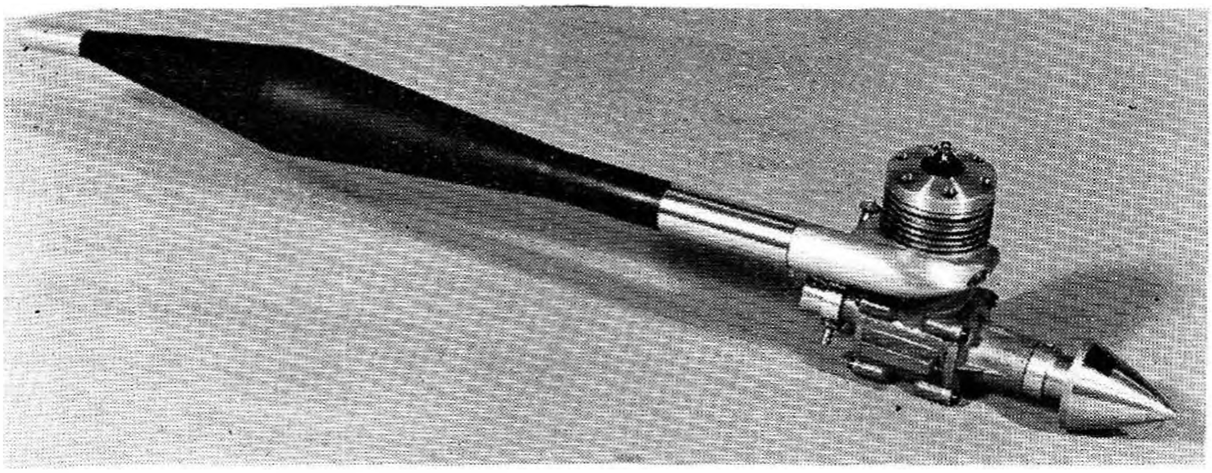


Figure 4.



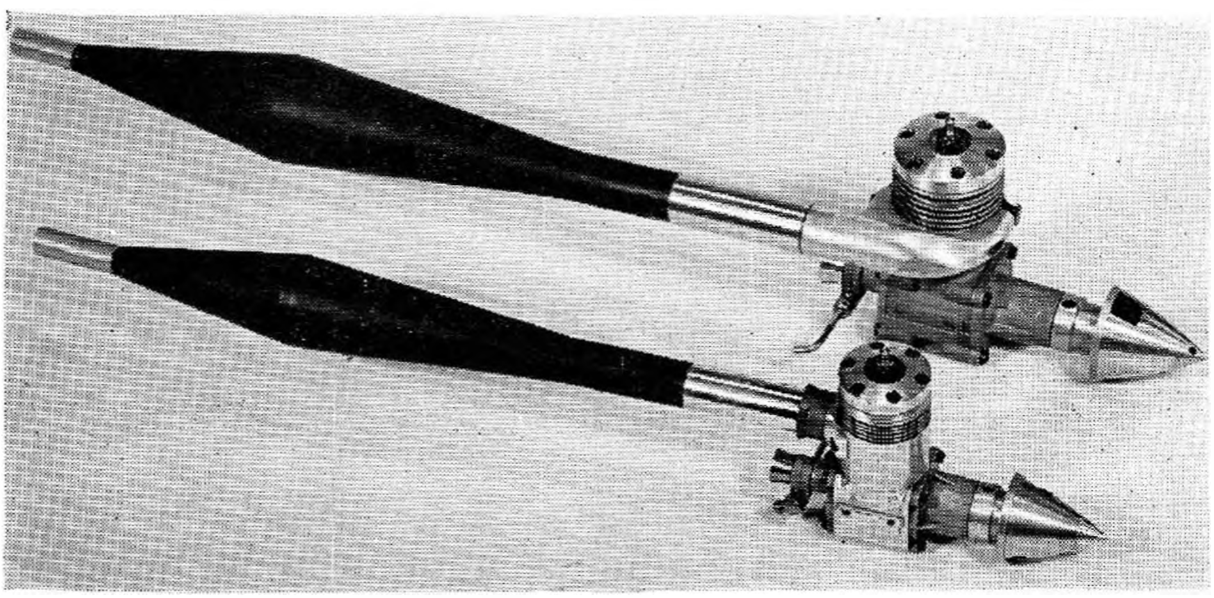
K&B Torpedo 29R with tuned exhaust and manifold.

The engine which was used in the World Championships and which has had the bulk of the development effort is a special engine of our own design which also uses some K&B 15 R components. During the past few months, however, we have been testing these systems on standard K&B engines with very gratifying results. We have gained up to 1500 r.p.m. with no other change to the engine other than adding a tuned exhaust pipe. Experiments with raising the exhaust port are still going on, and could yield a further performance increase.

I believe that the tuned exhaust system can work on any size of engine although there is a lot of development work to do for each new application. The tuned engine exhaust seems to have no harmful effect whatever on the engine. We have had thirty to forty high speed flights on each engine with no apparent wear at all. Fuel consumption is approximately 10% lower than normal even though the power output is increased considerably. We have obtained as many as twenty and never less than five flights per glow plug.

The engines are not hard to start, but adjusting the needle valve is quite

·15 T.W.A. (Theobald, Wisniewski Association) and K&B 29R with tuned exhausts.



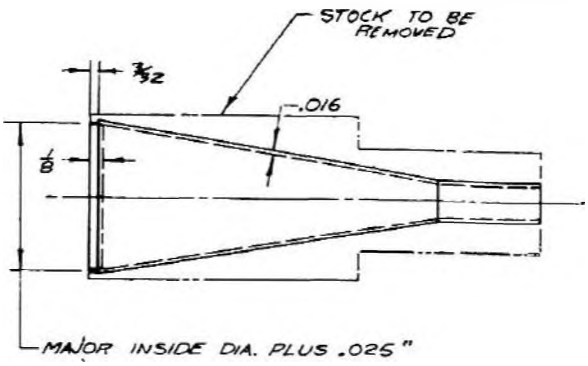


Figure 5.

different due to the garbled exhaust sound and reduction in noise. Once it is set, however, it does not have to be changed with each flight.

There seems to be some controversy about the tuned exhaust system. The tuned exhaust is not a startling new concept. It has been used for a good many years in several racing sports; Indianapolis racers, motor-cycles, sports cars, *etc.* All use some form of exhaust tuning. Roger and I have merely applied this thirty-year-old physics principle to model aeronautics.

True, this is not immediately available on the commercial market, but this has not stopped modellers before. They have a knack of turning the difficult task into an accomplished fact. This is where we progress in our sport.

Of course, you can go faster by using so called super fuels. Most of these exotic fuel ingredients are prohibitive in cost as well as being difficult to obtain. If not handled with extreme care, they can be very dangerous to your health.

I have tried to pass on to modellers the benefit of our six years of work and study. All construction details are given so that those who do not have the facilities to do the work may have someone else make it.

Most important, let us keep an open mind and not regress to the past, but rather progress to the future.

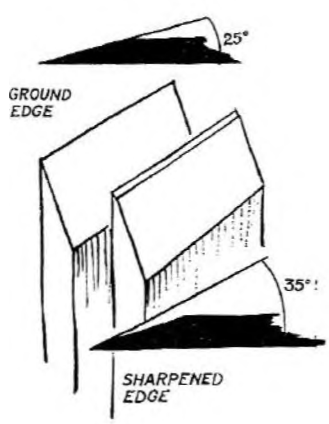
WOODWORK AND MODEL MAKING

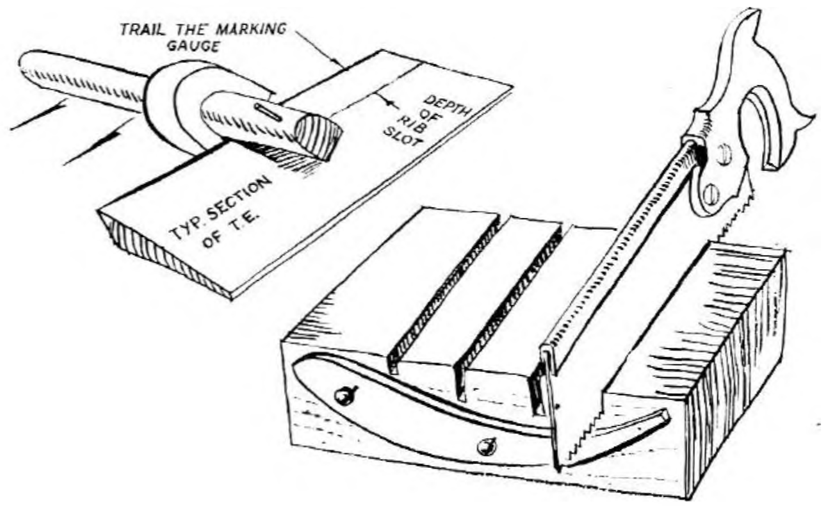
By T. Faulkner

The application of conventional woodworking tools and techniques to balsa model-making is seldom practised, yet convenience, accuracy and speed can benefit by using basic knowledge of how to measure, mark and cut wood. Balsa differs from other timbers by virtue of its lightness and softness. Only the latter characteristic affects the working properties of the wood, and this only to the extent of requiring the sharpest possible cutting edges along with shallow grinding angles (see below).

The following tools have been found of great practical value to the writer.

1. OILSTONE. I regard this as one of the most important items of my tool kit. In order to prepare any cutting edge, abrasive surfaces are used. The finer this surface the better edge it produces. Unfortunately, fine abrasives work slowly and a choice of coarse or fine is an advantage. Satisfactory stones with two contrasting surfaces and measuring 8 in. × 2 in. cost about 10/-





Oilstones should always be boxed for protection and as a means of screwing to a bench. Ultimate sharpness is achieved by stropping; the thicker skin on the palm of the hand is quite satisfactory for this purpose.

The use of the stone to sharpen the blade of a plane is described because this procedure holds good for most cutting edges.

A sloping edge is rubbed on the blade at about 25°: this is the "grinding angle". A new plane should have this surface accurately ground; a much used blade needs to be cut back, and for this the coarse surface of the stone is used.

The stone is charged with thin oil, the blade held so that its whole width is accommodated on the stone, and sloping at 25° to the horizontal. Keeping this angle constant, the blade is rubbed backwards and forwards on the stone the oil charging being carried out whenever the stone dries. When the bright surface extends the full width of the blade, cutting back is complete. Sharpening comes next, using the finer side of the stone. This time the blade is held at between 30°-35° and rubbed until a roughness may be detected on its flat side.

The roughness or "fash" signifies that sharpening is complete: its removal is effected by reversing the blade and rubbing its flat side absolutely flat on the stone. An obstinate "fash" may require alternate sharpening and flatting strokes, but the flat side is *never* angled to the stone. The full process produces a shaving edge which may be improved by stropping. The edge always "trails" across the palm when stropping, for obvious reasons.

2. PLANE. This tool is useful for shaping T.E. and L.E. sections, for tapering or triangulating longerons, and for surface preparations on hard blocks: the blade is always set fine for balsa.

Trailing Edges are shaped on the edges of sheet of the correct thickness: the required width is marked and the sheet pinned or tack-cemented to the board. The plane is held on the waste corner at the correct slope, slightly angled to the line of the grain. (This gives a "slicing" cut, the blade working as though it is sharper than is really the case.) (See diag. page 43.)

Tapered Longerons and Spars: Sellotape holds the full thickness ends together; opposite ends are tack-cemented. The thick ends are pinned to the bench, and the plane used away from these ends.

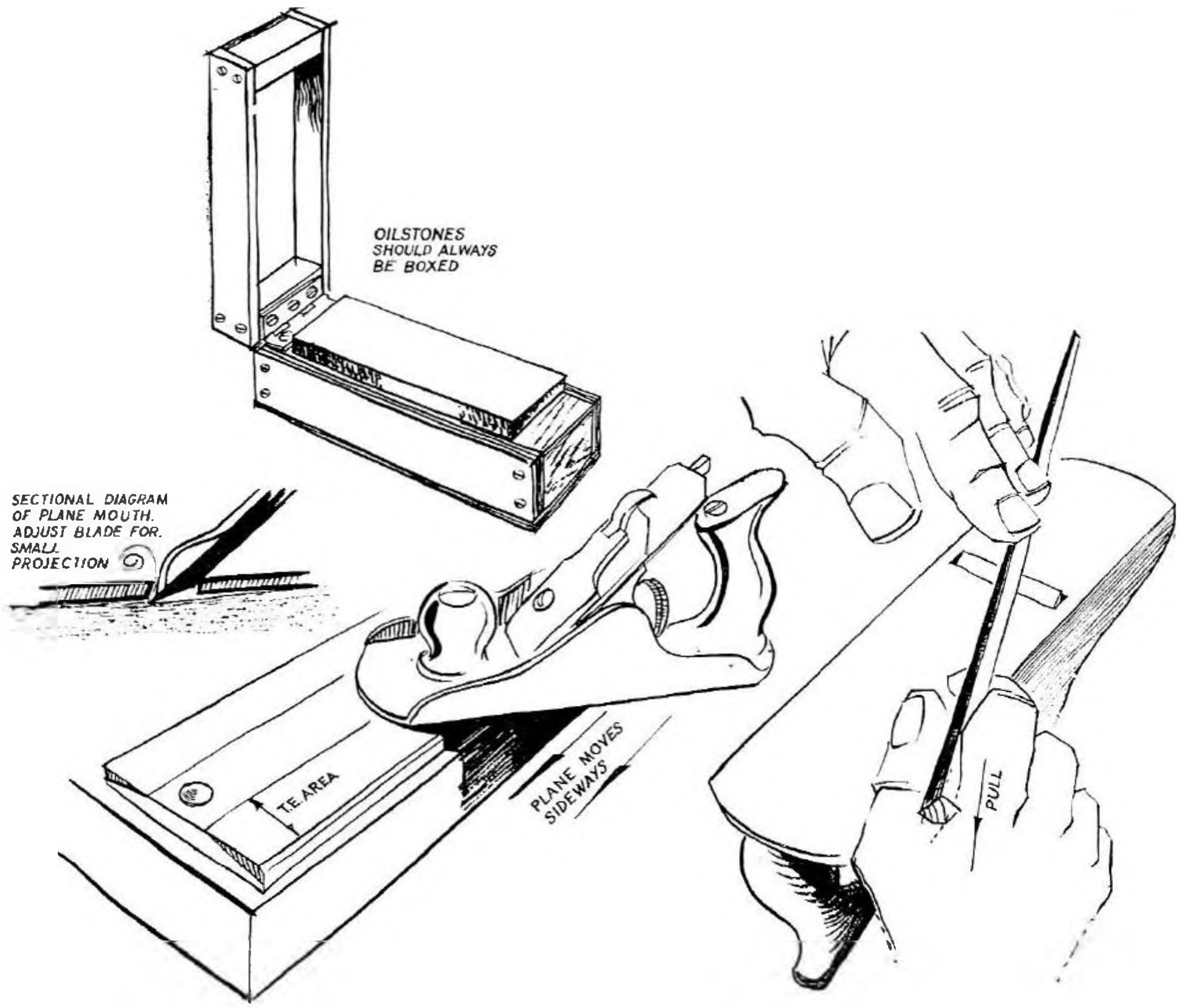
L.E. and Triangular Sections: strip for these components is passed over the plane which is held upside down in one hand, between the knees or (lightly) in a vice. Finger or thumb-tip pressure maintains contact between work and blade, the strip being pulled across the sole of the plane by the other hand.

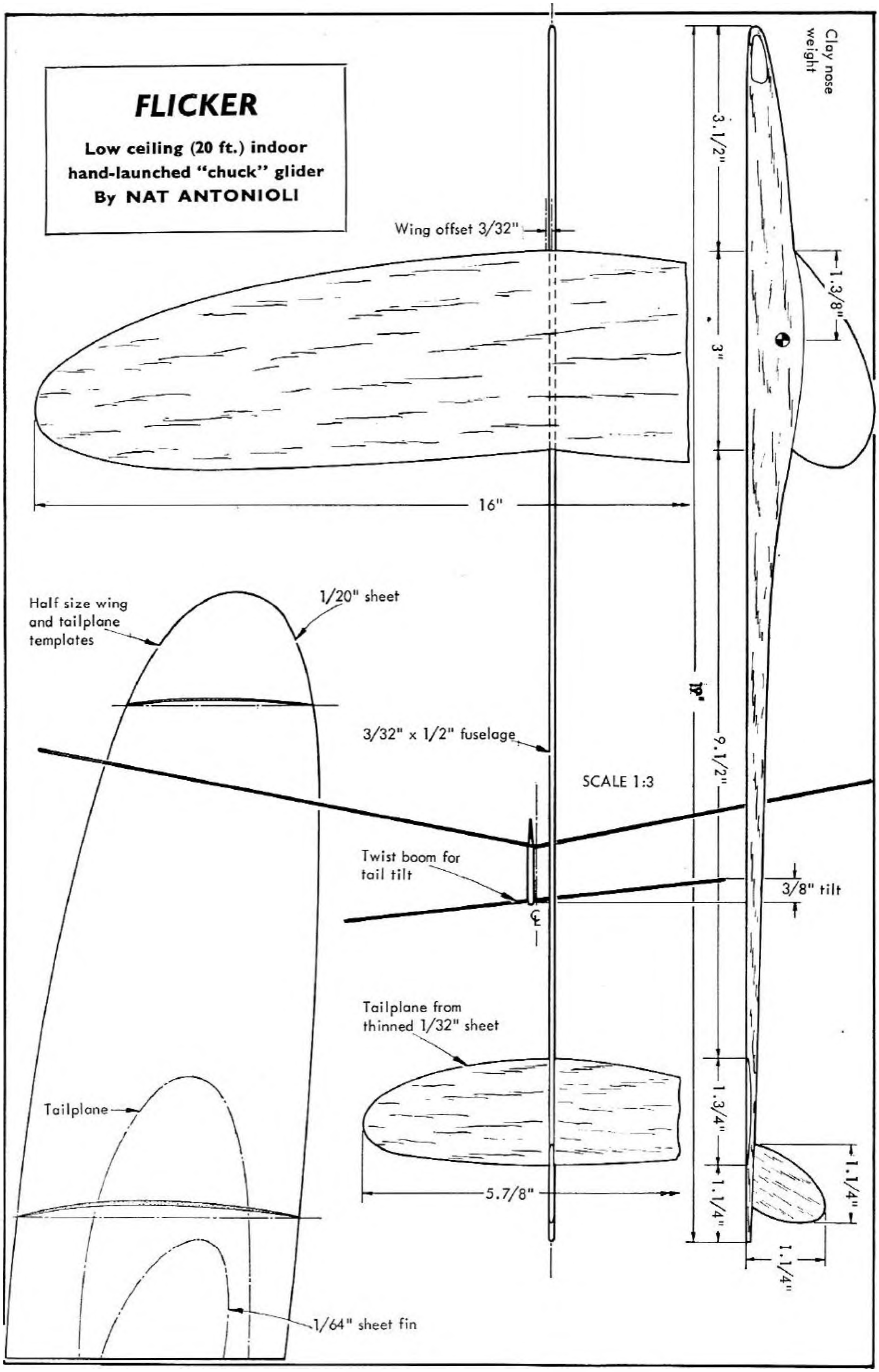
Building Boards: Perhaps the most useful device "planed up" by the writer has been a curved building board. This matches the undercamber of the wing section generally used, and avoids the tiresome packing of spars and T.E. sections.

3. MARKING AND CUTTING GAUGES. Semi-automatic marking to length or, more commonly, width is possible with these tools, *e.g.*, lengths of rib slots in T.E. stock, wing box parts, parallel edge sheet fillings, T.E. strips from sheet, *etc.* Gauges are always "trailed" along the work, a light cut or mark acting as a guide for subsequent strokes in depth.

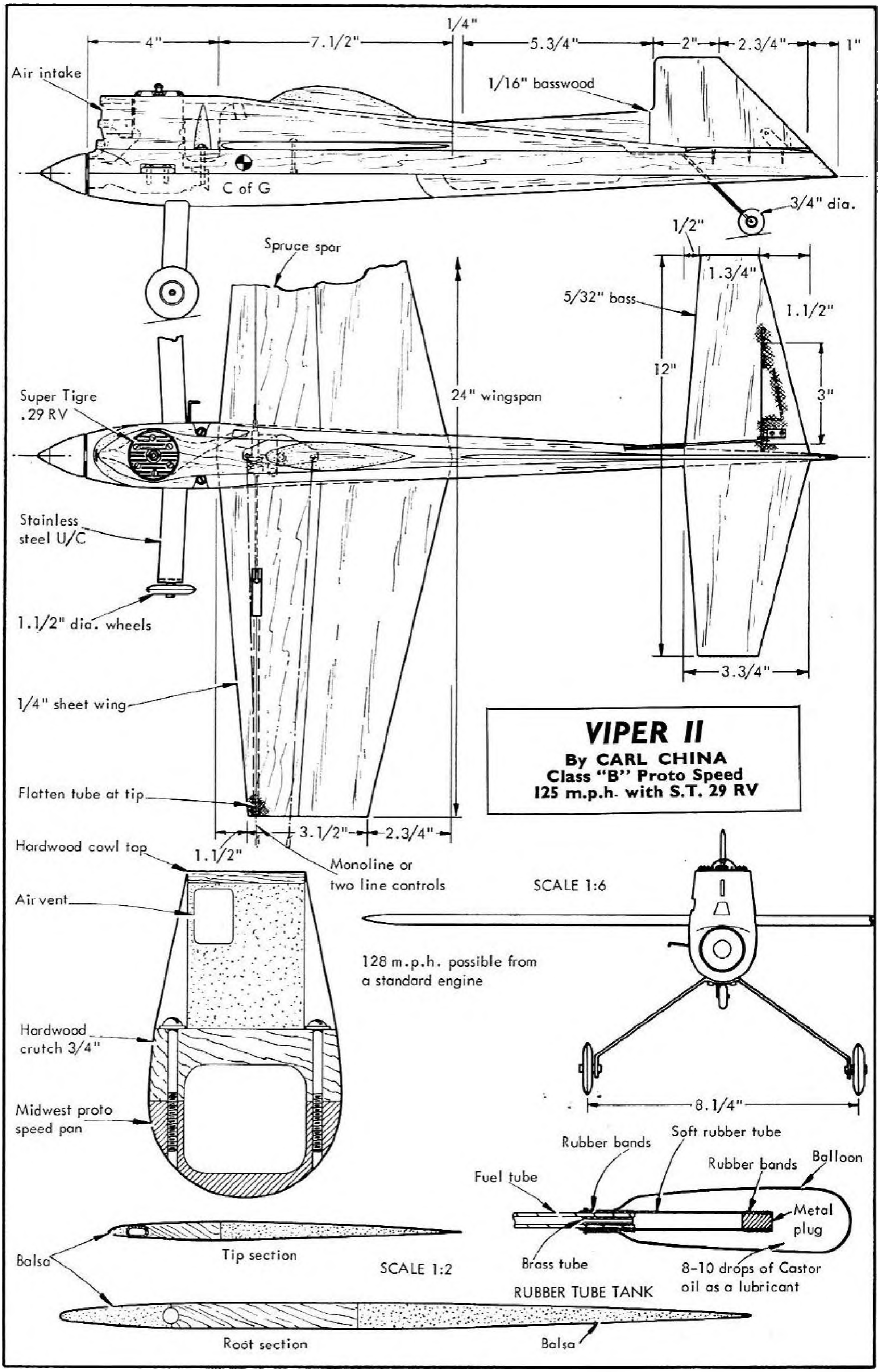
4. TRY SQUARE. This tool is really a "maid of all work": its internal and external 90° angles have frequent uses, the steel blade and metal faced stock are convenient marking or cutting surfaces, whilst the tool may stand on its stock to assist in aligning components.

5. DOVETAIL OR BACK SAW. Valuable for the speed and accuracy with which block, "hardwoods" and heavy sheets may be cut. Additionally blocks formed by wing or tail ends "sandwiched" for identical profiling may have spar recesses removed in this way. Similarly the waste removal from blocks of undercambered ribs is assisted by judicious cross-grain cutting, and the rough profiling of upper rib surfaces is facilitated. The finest point size of tooth should give the best results, while the stiff blade remains true indefinitely. In conclusion, the writer hopes that these brief notes will assist other modellers to the extent that the tools mentioned have assisted him!

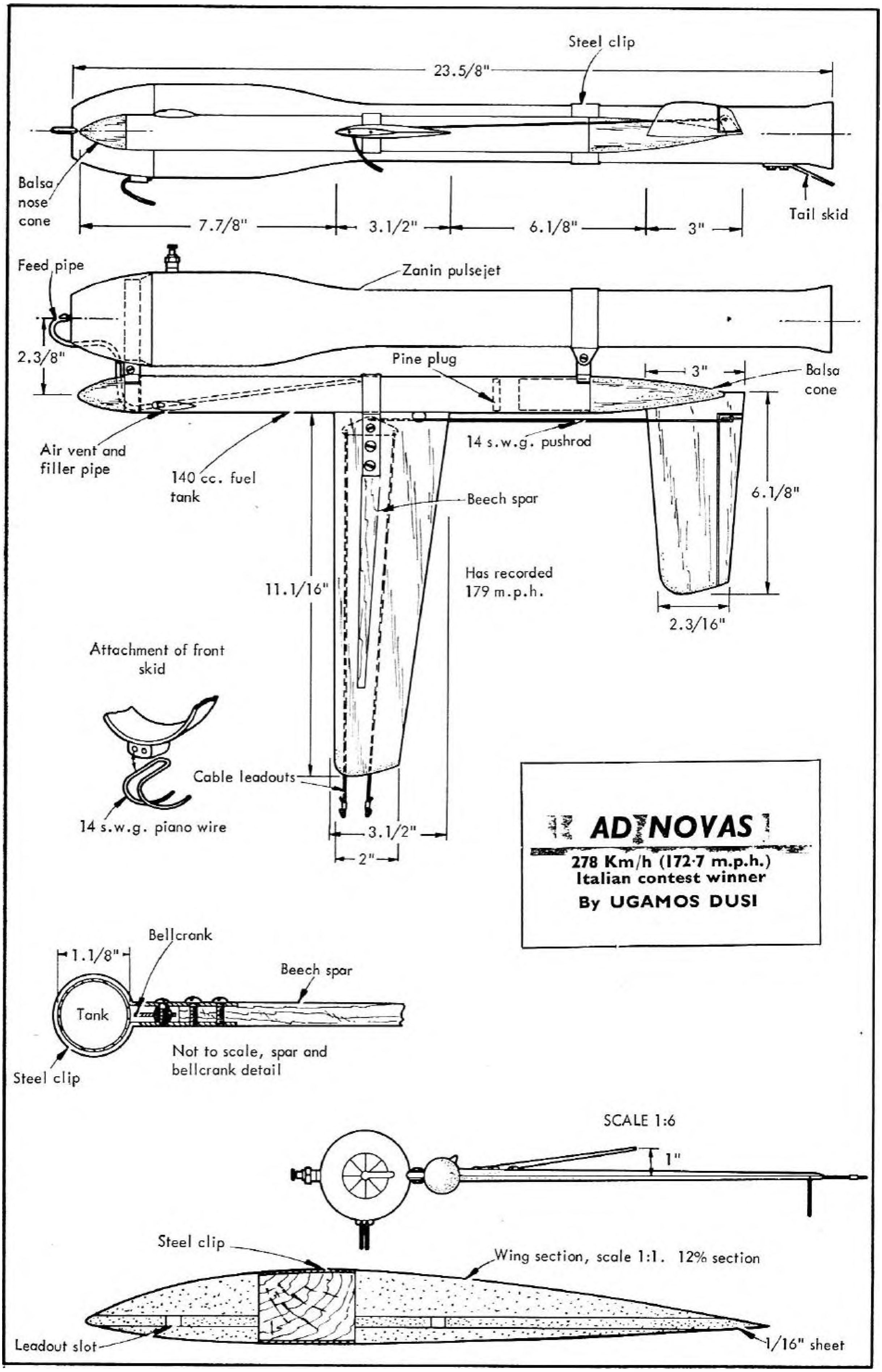




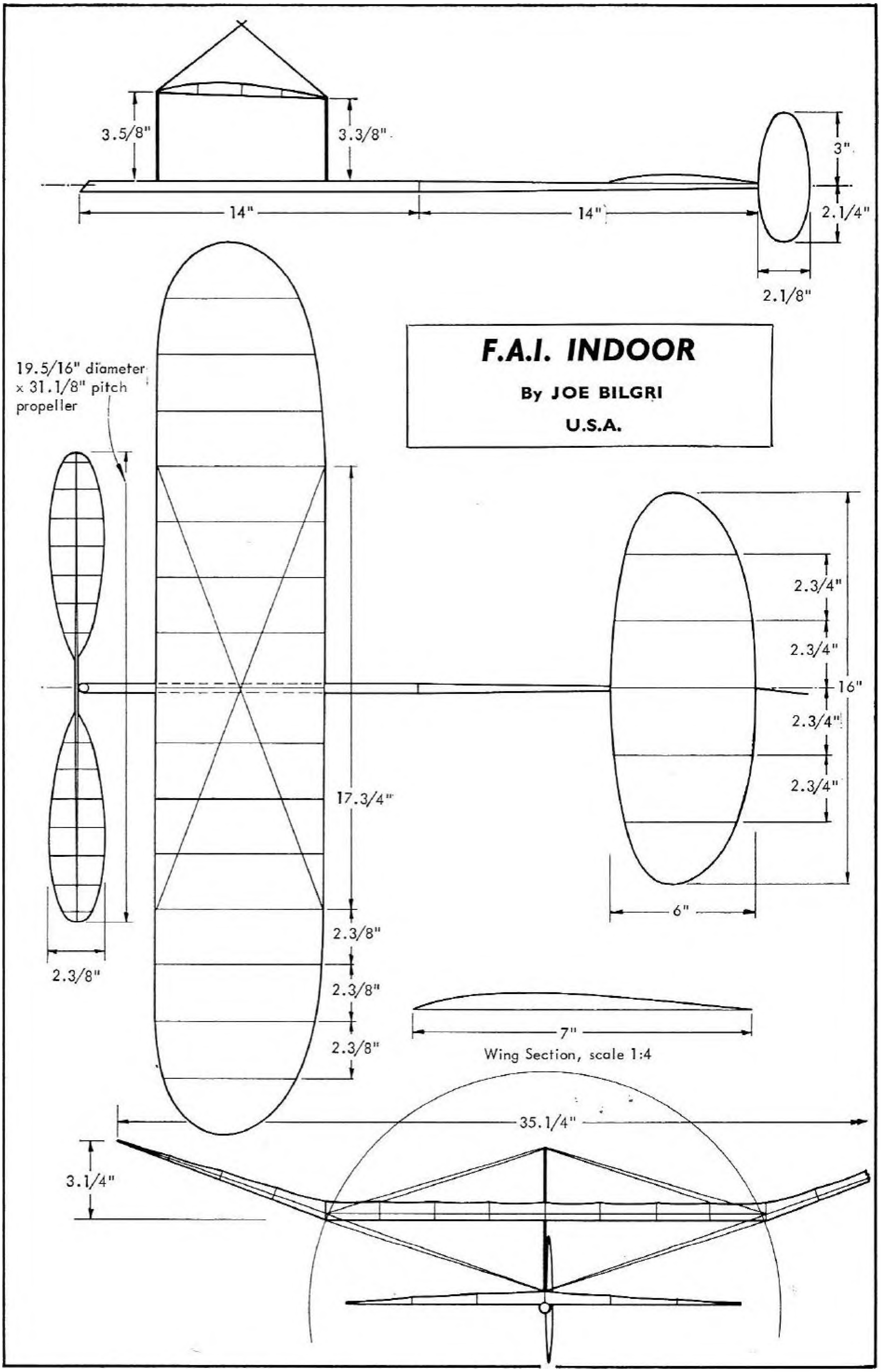
INDOOR NEWS AND VIEWS, U.S.A.



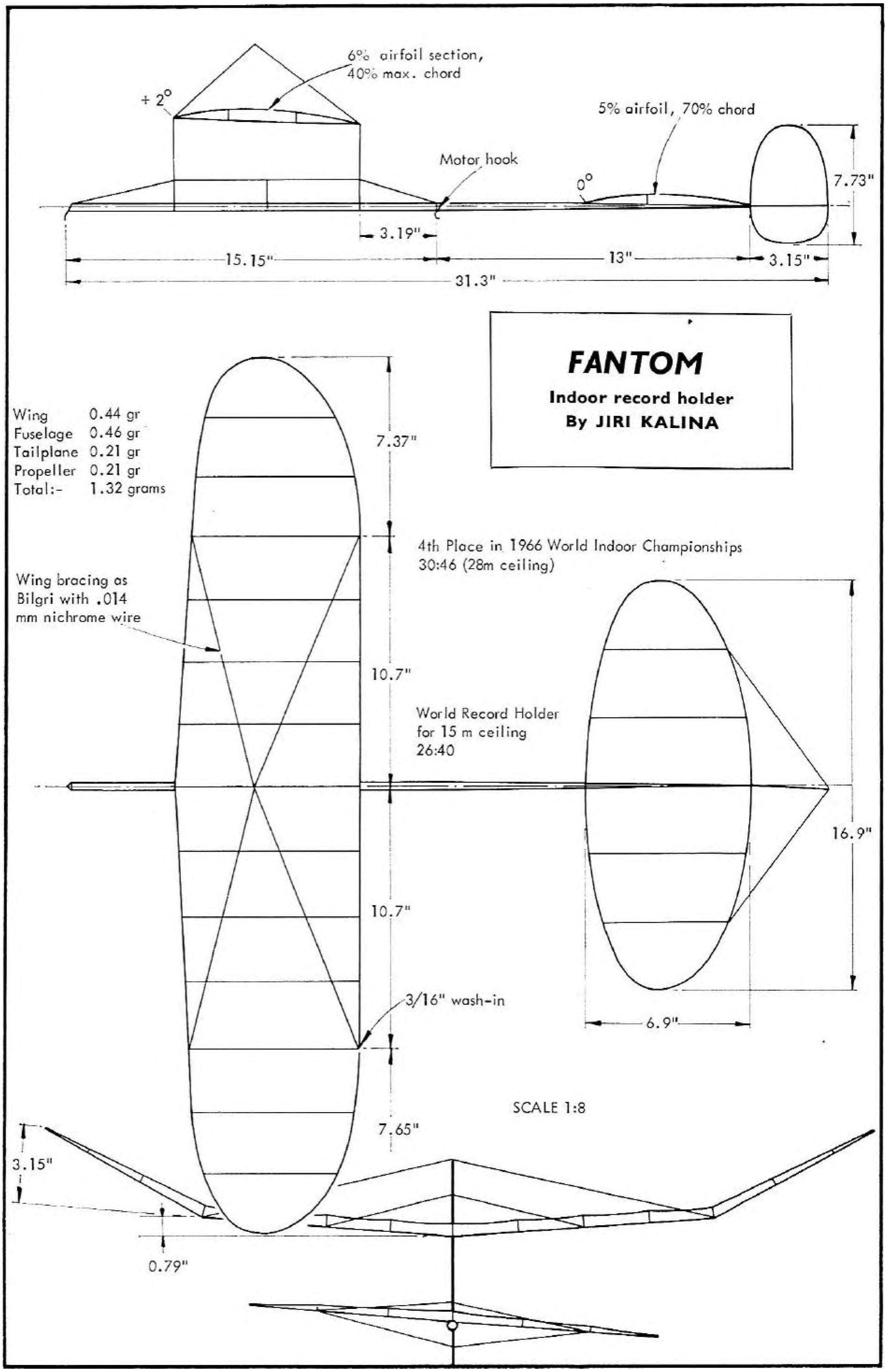
MODEL AIRPLANE NEWS, U.S.A.



MODELLISTICA, ITALY



VIA MODELLEZES, HUNGARY



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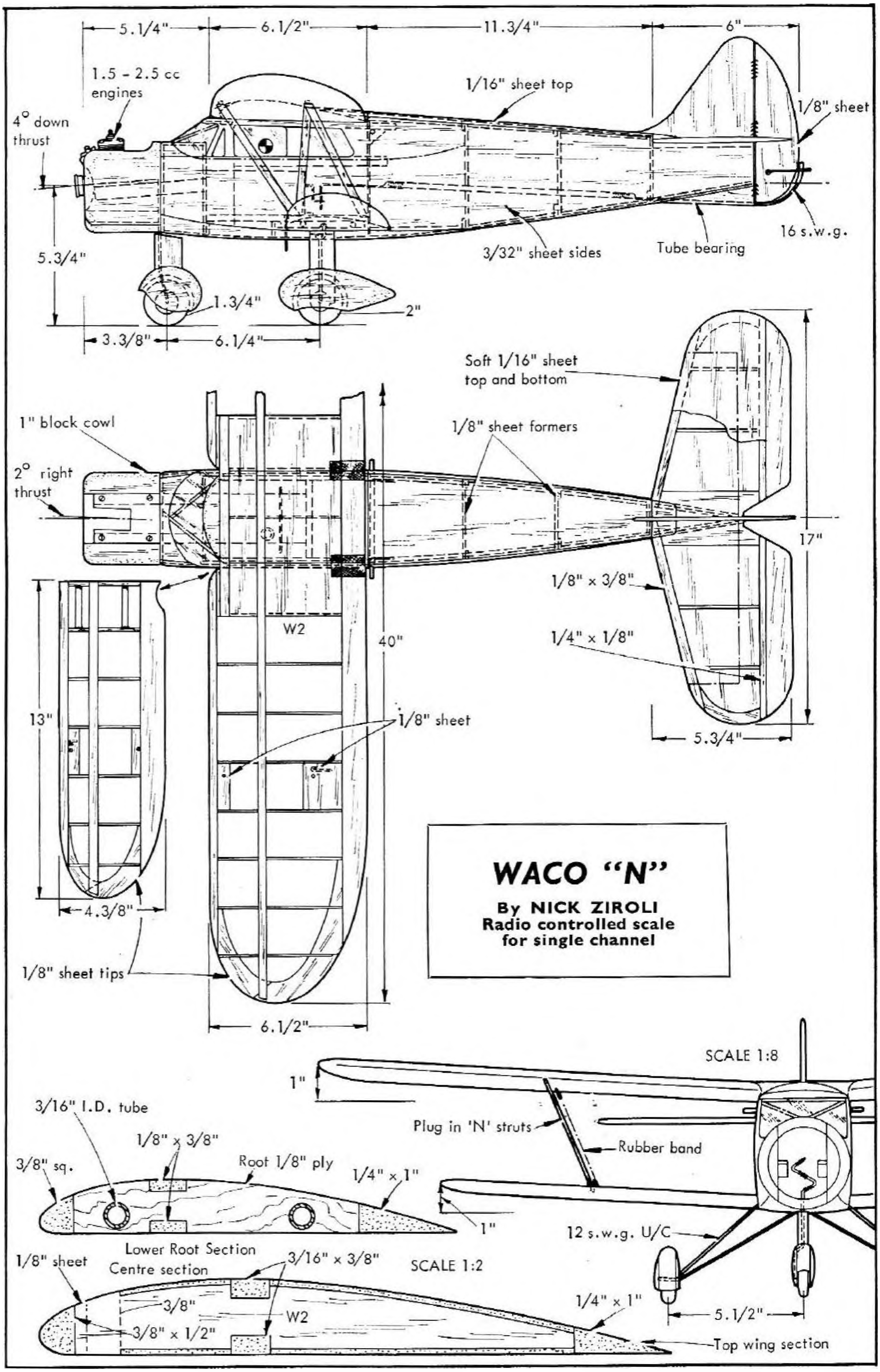


WACO "N"

By NICK ZIROLI
Radio controlled scale for single channel

JAPANESE WORLD WAR II COLOUR SCHEMES

by Dr. M. F. Hawkins

Although the colouring of Japanese aircraft in World War II followed certain general patterns, it was, as Kikuo Hashimoto has written, "not of the uniform" and any description must be a theme with variations.

Unit markings and identification stripes, in Army aircraft especially, were colourful, picturesque and varied, and are a subject in themselves. Apart from a Kana character designating base, used by the Navy at the beginning of the war, Japanese script was not often used in aircraft markings. Aircraft in service were often extremely "tatty" in appearance, with chipped and peeling paint revealing bare metal underneath.

Over the last few years, a good deal of new information has come to light, and it is now possible to revise some of the notes previously published on this subject.

In 1937 the "China Incident" blew up and Japanese Naval aircraft were committed over China on operations. Fighters were usually silver, with black cowlings and red tail surfaces, although one pilot is reported to have painted his A5M4 Claud sky blue all over! Bombers were shadow shaded green and purplish brown on the upper surfaces and pale grey underneath. An example of this scheme was the G3M2 Nell, some of which bombed China, operating from bases in Japan. The first transoceanic air raids. Some carrier borne bombers, B5N1 Kates operated alongside the fighters and used the same silver colour scheme with black cowlings.

During this period Naval aircraft frequently carried a white "combat stripe" around the rear fuselage.

Reports of the Pearl Harbour attack speak of the Japanese aircraft being painted in a red and yellow colour scheme; however it is now known that a variety of schemes were in use at this time. The raid was led by Cdr. Mitsu Fuchida in a B5N2 Kate which was silver with three red bars on the yellow tail. Other aircraft, however, were dark green and pale grey underneath, green mottle on silver, and yellow fuselage with black nose and green and brown mottle above the wing. Most Zeros at this time were pale grey all over.

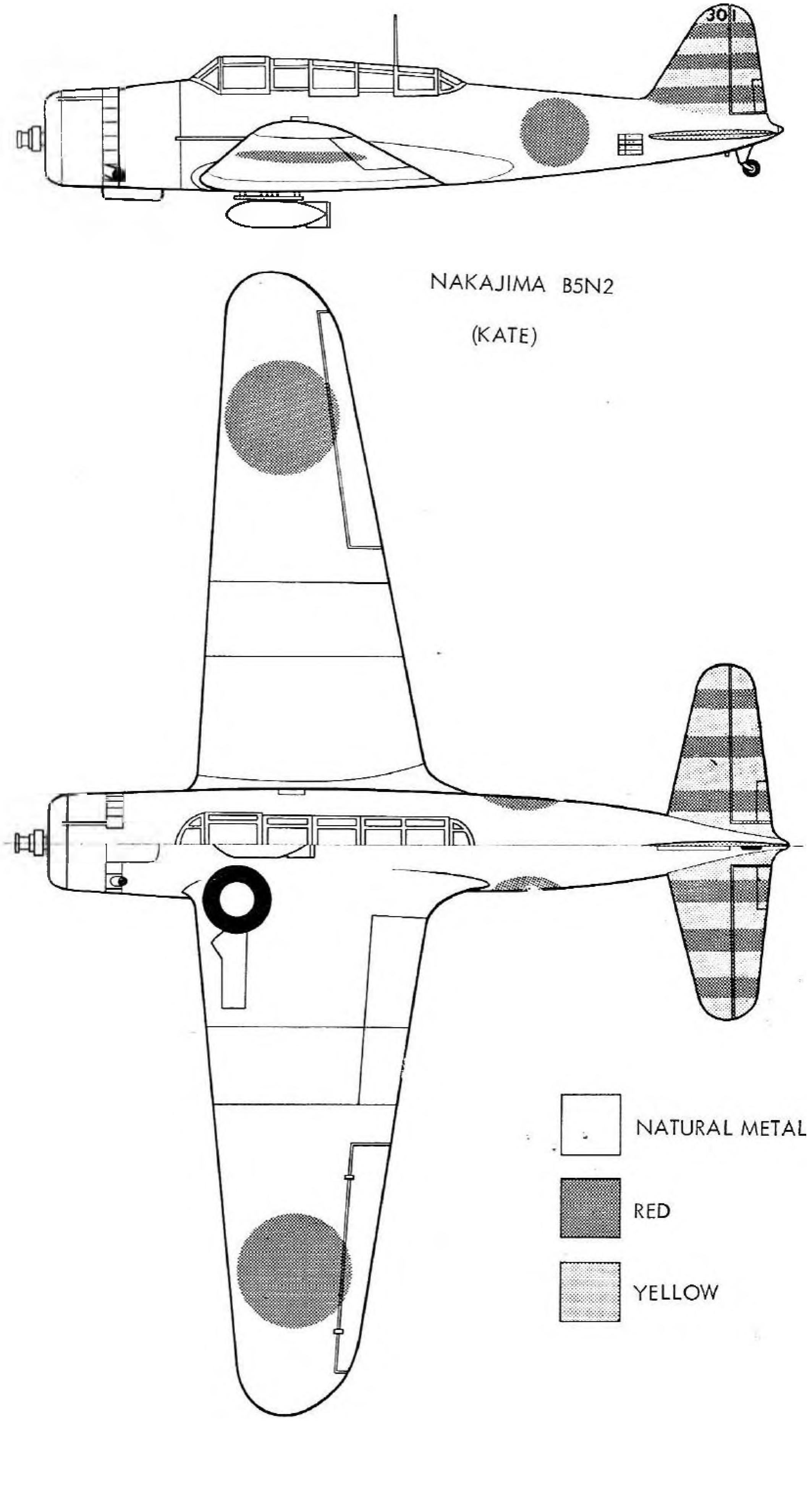
In 1942 dark green above and pale grey below, became the standard colouring for all Naval aircraft but there were some exceptions, described later. The green used was a mixture of four parts of sea green to one part olive drab.

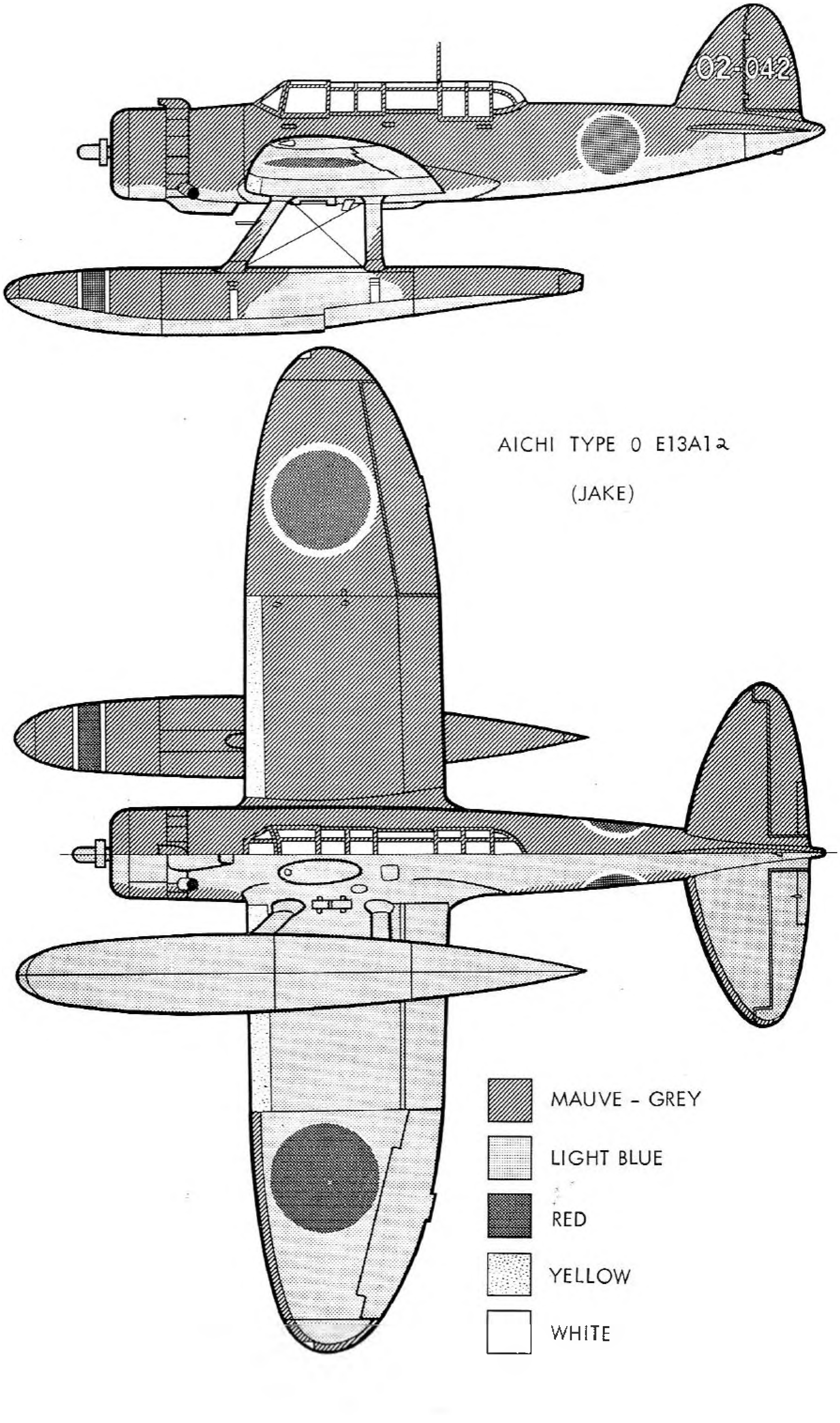
The national marking was a plain red disc, the Hinomaru. Usually this was outlined by a thin white ring, but the outline was unusual under the wing.

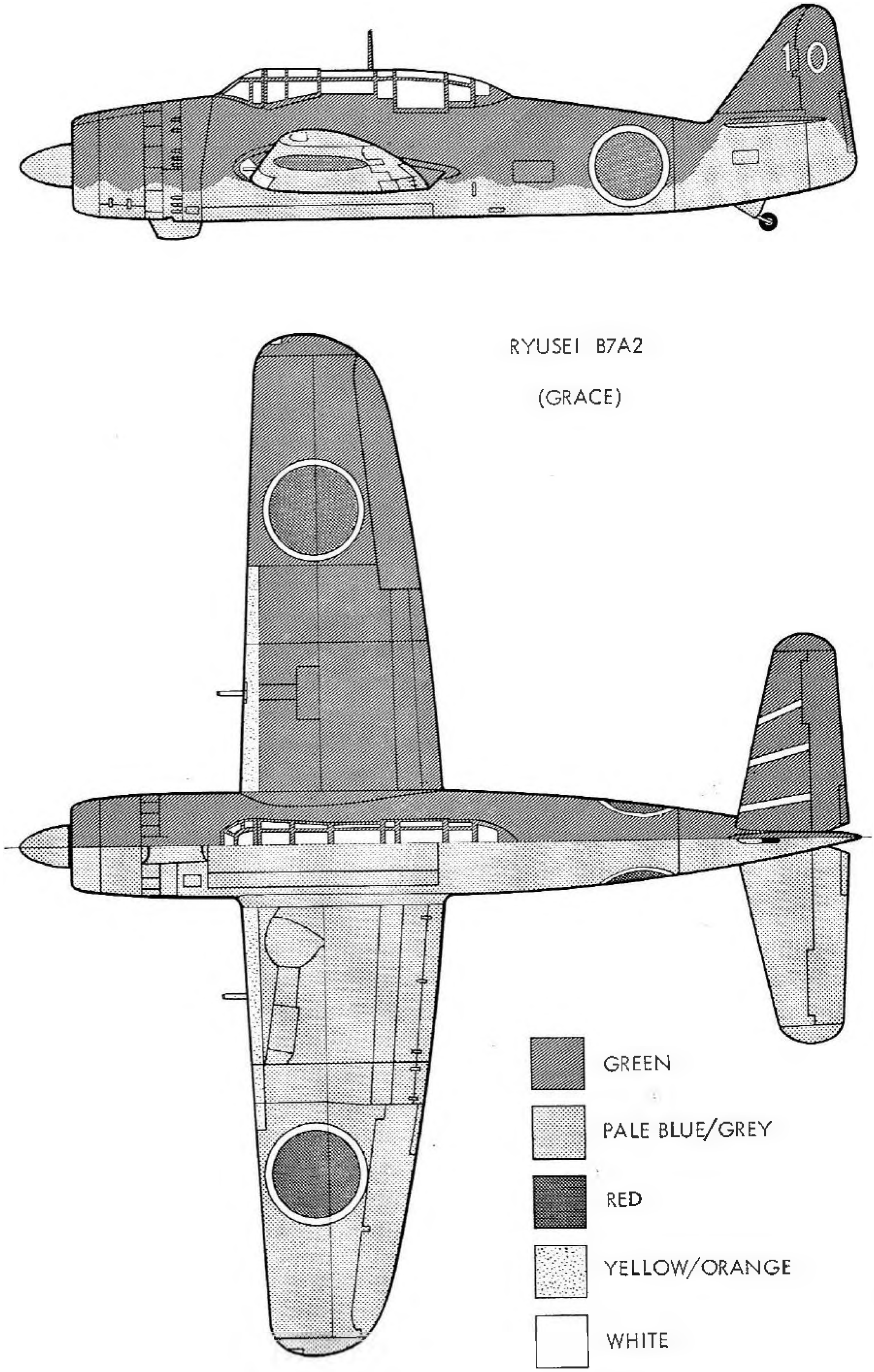
An orange yellow band, 18 in. wide, was standard along the inner half of the leading edge. In the early days of the war some fighters carried the Japanese word "Hokokugo" (Patriotism) and a number on the fuselage, indicating that the aircraft had been bought by public subscription.

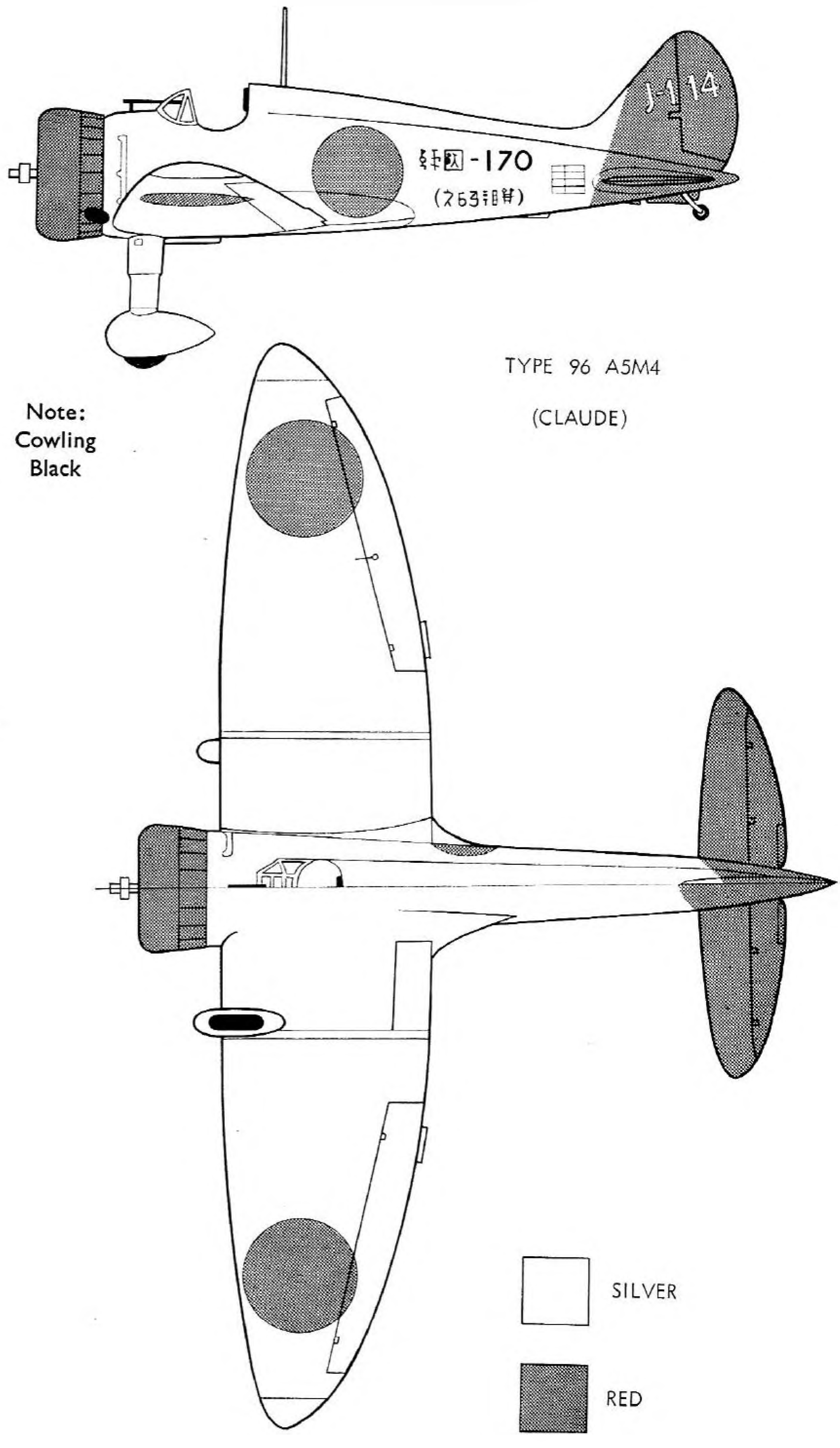
The radiating white bars on the upper surface of the stabiliser of some torpedo aircraft were "aim-off" marks for the gunner.

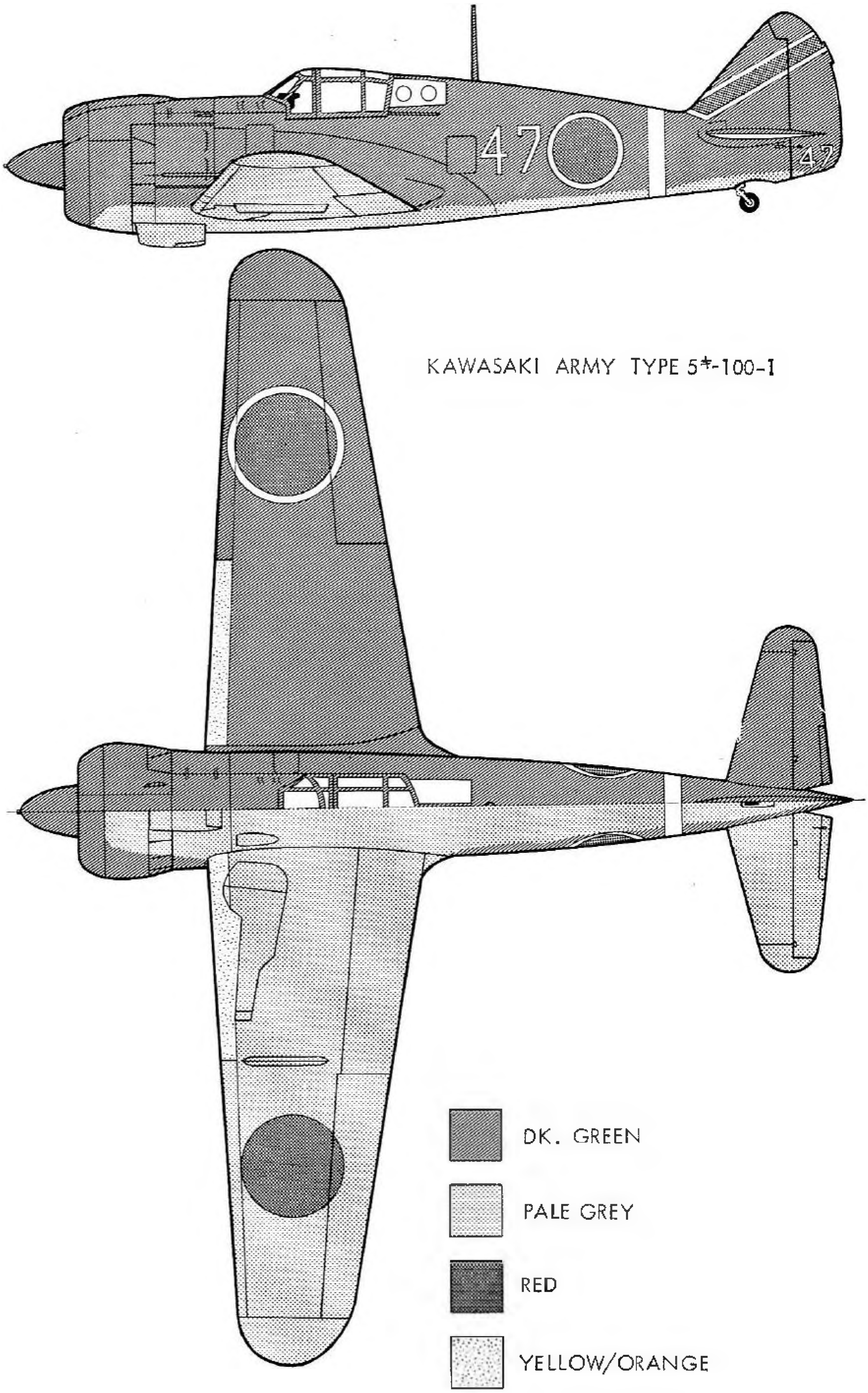
Propellers were usually dark green, with two red bars at the tips.


301
NAKAJIMA B5N2
(KATE)
NATURAL METAL
RED
YELLOW


02-042
AICHI TYPE 0 E13A1a
(JAKE)
MAUVE - GREY
LIGHT BLUE
RED
YELLOW
WHITE


10
RYUSEI B7A2
(GRACE)
GREEN
PALE BLUE/GREY
RED
YELLOW/ORANGE
WHITE


J-114
-170
TYPE 96 A5M4
(CLAUDE)
Note:
Cowling
Black
SILVER
RED


47
47
KAWASAKI ARMY TYPE 5*-100-I
DK. GREEN
PALE GREY
RED
YELLOW/ORANGE

Tail numbers varied during the war. At first a Kana symbol gave the base or carrier, and a three figure number for each aircraft started with 1 for fighters, 2 for dive bombers, and 3 for torpedo bombers. Soon after Pearl Harbour this was altered to a letter and number for each unit, *e.g.*, A1—the carrier Akagi, and AII for Kaga. Later in the war the scheme changed again and an all number code was used.

The G4M1 Betty shows the alternative square surround to the fuselage Hinomaru used with the dark green—pale grey colour scheme. This was also seen on some B5N1 Kates, but not on fighters.

The B4M2 Betty was a captured aircraft flown by Tech Air Intelligence, South West Pacific Area and was natural metal with American markings, including pre-war style red, white and blue rudder stripes and national markings on top of both wings. Some of these captured aircraft were later repainted with Japanese "suns" and put on show at the end of the war. The B6N2 Jill is an example. The anti-dazzle panel and spinner were matt dark green, but the rest was bare metal.

Pre-war floatplanes were silver but later a mauve-grey, pale blue colour scheme was introduced. There was a red band, outlined in white at the level of the propeller, marked on the floats, as on the E13A1a Jake. Some A6M2-N Rufe floatplane fighters were pale grey all over but examples of both these types, seen at Marcus Island in 1943 were dark green with pale grey underneath.

The C6N2 Myrt is a much lighter shade of green than usual and is bare metal underneath. The cowl is black, as was common with most Naval aircraft, although Mitsubish used a deep prussian blue rather than pure black.

Towards the end of the war aircraft were often seen with no individual marks or surround to the Hinomaru. The Q1W1 Lorna is an example of this scheme.

It is interesting to note that even during the war years new prototypes of Naval aircraft under test, usually at Yokosuka, were still painted in a gaudy orange-yellow colour, with black trim on the cowlings. Examples were the Kawanishi N1K1 Rex, Aichi D4Y3 Judy and a Yokosuka P1Y1 Frances.

Trainers, such as the K11W1 Shiriagiku were commonly orange all over right up to the end of the war when the continual presence of the U.S. air forces over the Home Islands made such a gaudy scheme imprudent.

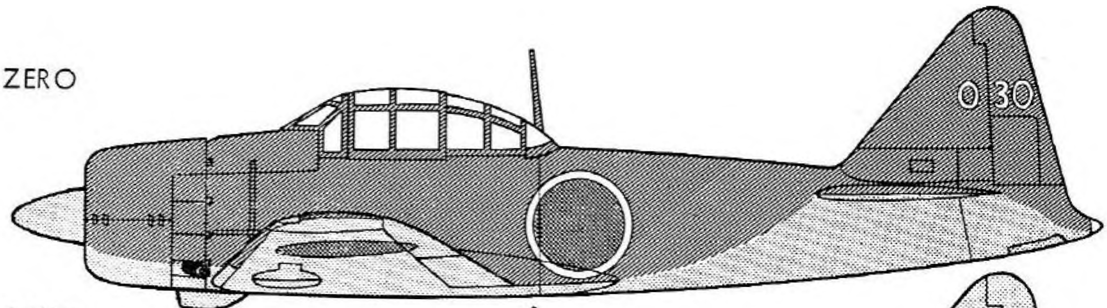
Finally, the G4M1 transport is painted all white with green crosses, in the colours laid down by General MacArthur's headquarters for Japanese aircraft required to fly after the surrender. The aircraft is one of two that brought Lt. Gen. Kawabe Takashiro and his staff from Japan to Ie Shima in the Ryukyu Islands on August 19th, 1945, where he transferred to a C54 on his way to Manila to arrange the surrender.

During the "China Incident" fighters were commonly pale grey all over as the Ki 27 Nate which has the blue and white sign of the Akeno Fighter Training School on its yellow rudder. The fuselage strips and cowl ring are also yellow.

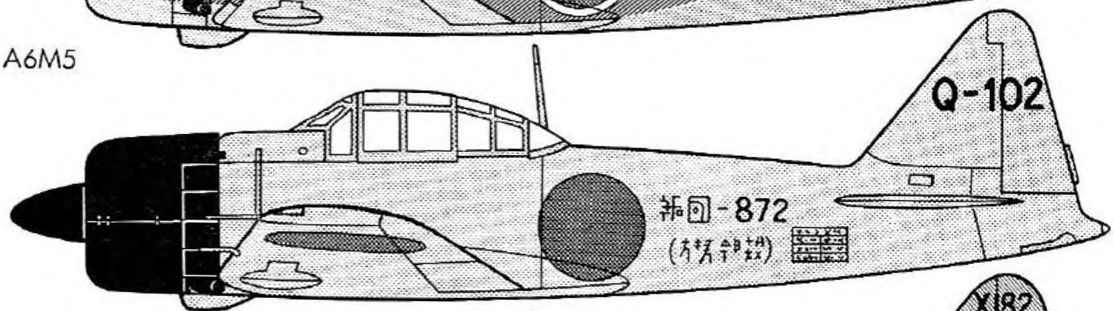
Army co-operation aircraft carried purple, grey and olive green camouflage and were pale grey underneath, as the Ki 32 Mary which carried a white "combat stripe".

Heavy bombers, such as the Ki 21 Sally, were usually a fairly dark grey all over, but some aircraft of this type were camouflaged grey and purple with a thin sky blue line dividing the coloured patches.

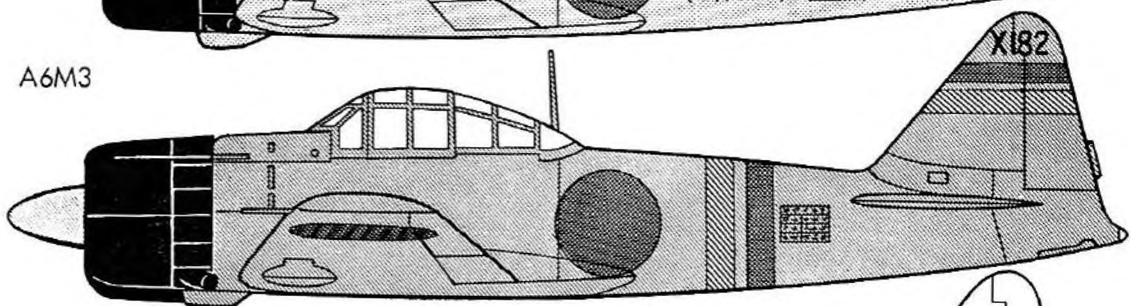
ZERO



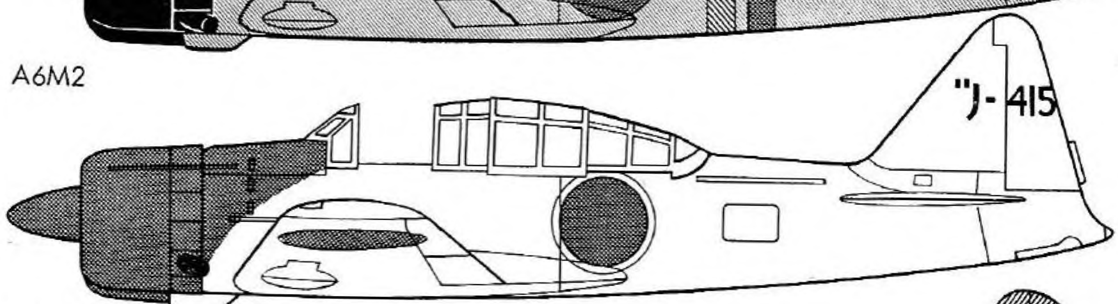
A6M5



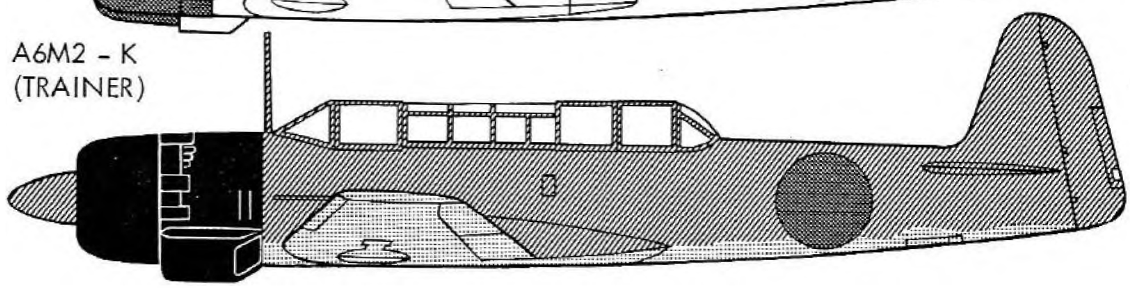
A6M3



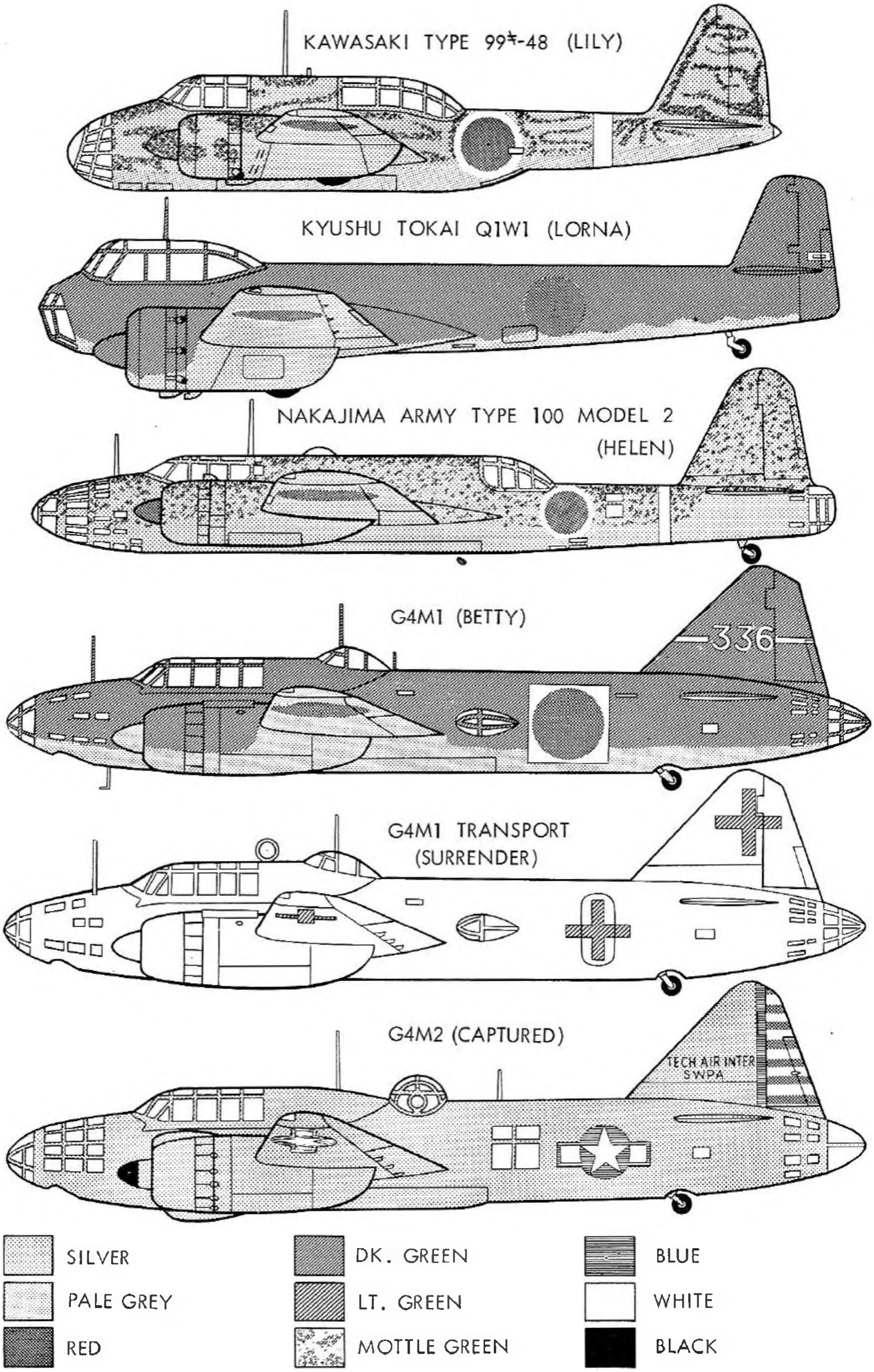
A6M2

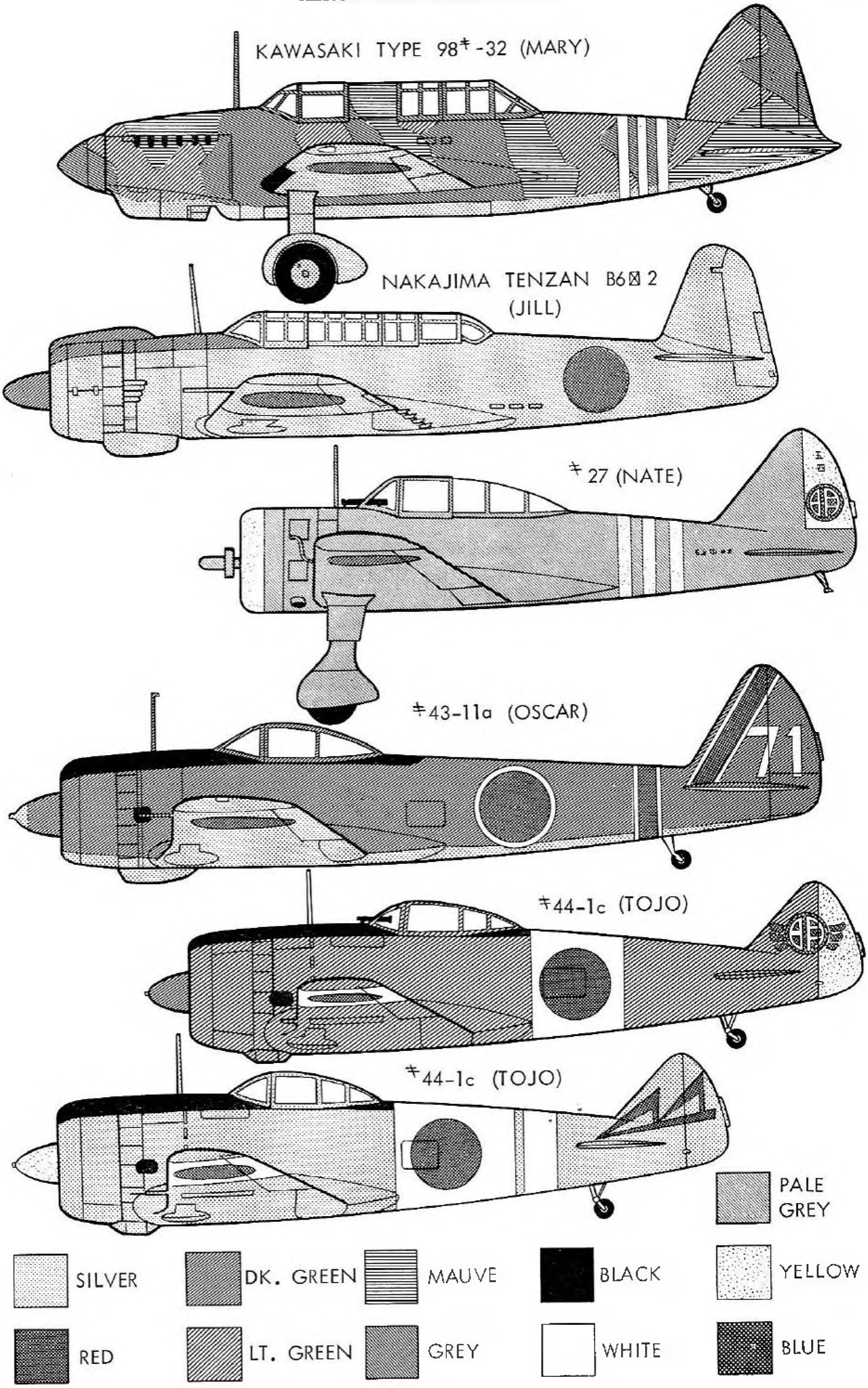


A6M2 - K
(TRAINER)



NAKAJIMA SAIUN C6N1
(MYRT)


KAWASAKI TYPE 99キ-48 (LILY)
KYUSHU TOKAI Q1W1 (LORNA)
NAKAJIMA ARMY TYPE 100 MODEL 2 (HELEN)
G4M1 (BETTY)
336
G4M1 TRANSPORT (SURRENDER)
G4M2 (CAPTURED)
TECH AIR INTER SWPA
SILVER
PALE GREY
RED
DK. GREEN
LT. GREEN
MOTTLE GREEN
BLUE
WHITE
BLACK


KAWASAKI TYPE 98キ-32 (MARY)
NAKAJIMA TENZAN
(JILL)
キ27 (NATE)
キ43-11a (OSCAR)
71
キ44-1c (TOJO)
キ44-1c (TOJO)
PALE GREY
SILVER
DK. GREEN
MAUVE
BLACK
YELLOW
RED
LT. GREEN
GREY
WHITE
BLUE

After the war became general in the Pacific area, and the Japanese Army started to impose the "Greater Asia Co-Prosperity Sphere" on its inhabitants, they adopted a standard camouflage of jungle green applied over pale grey or bare metal. The pattern was left to the man with the spray gun or brush, and could be streaks, as the Ki 48 Lily, a fine stripe, as on the Ki 49 Helen, or a mottle pattern as on the Ki 45 Nick of the 53rd Sentai (Squadron) of the 10th Air Division. This plane had red spinners with white tips, a red and white arrow on the fuselage and a blue and white Sentai mark on the tail. It is interesting to note that the colour of the Sentai mark denoted the Flight. The usual colours were: 1st Flight—white;
2nd Flight—red;
3rd Flight—yellow or blue.

Home defence fighter units had the Hinomaru applied on a white band around the fuselage and wing.

Just for variety, the aircraft could be dark green and bare metal like the Ki 43 Oscar of the 59th Sentai, which has red bands on the fin and rear fuselage, or all silver, with black decking as the Ki 44 Tojo of the 47th Sentai (red mark on tail) or even pale green all over as the Ki 44 Tojo of the Akeno Fighter School (yellow rudder).

However, by the end of the war, dark green and pale grey was the commonest scheme, as on the Ki 100 of the 59th Sentai. This aircraft had a red Sentai mark and an orange-yellow leading edge, as was usual on Naval aircraft.

Most Army aircraft had a white "combat stripe" around the rear fuselage.

Aircraft interiors were usually a dull yellowish green but occasionally a silvery blue was used. The Ki 100 stored at R.A.F. Cosford has a matt black cockpit.

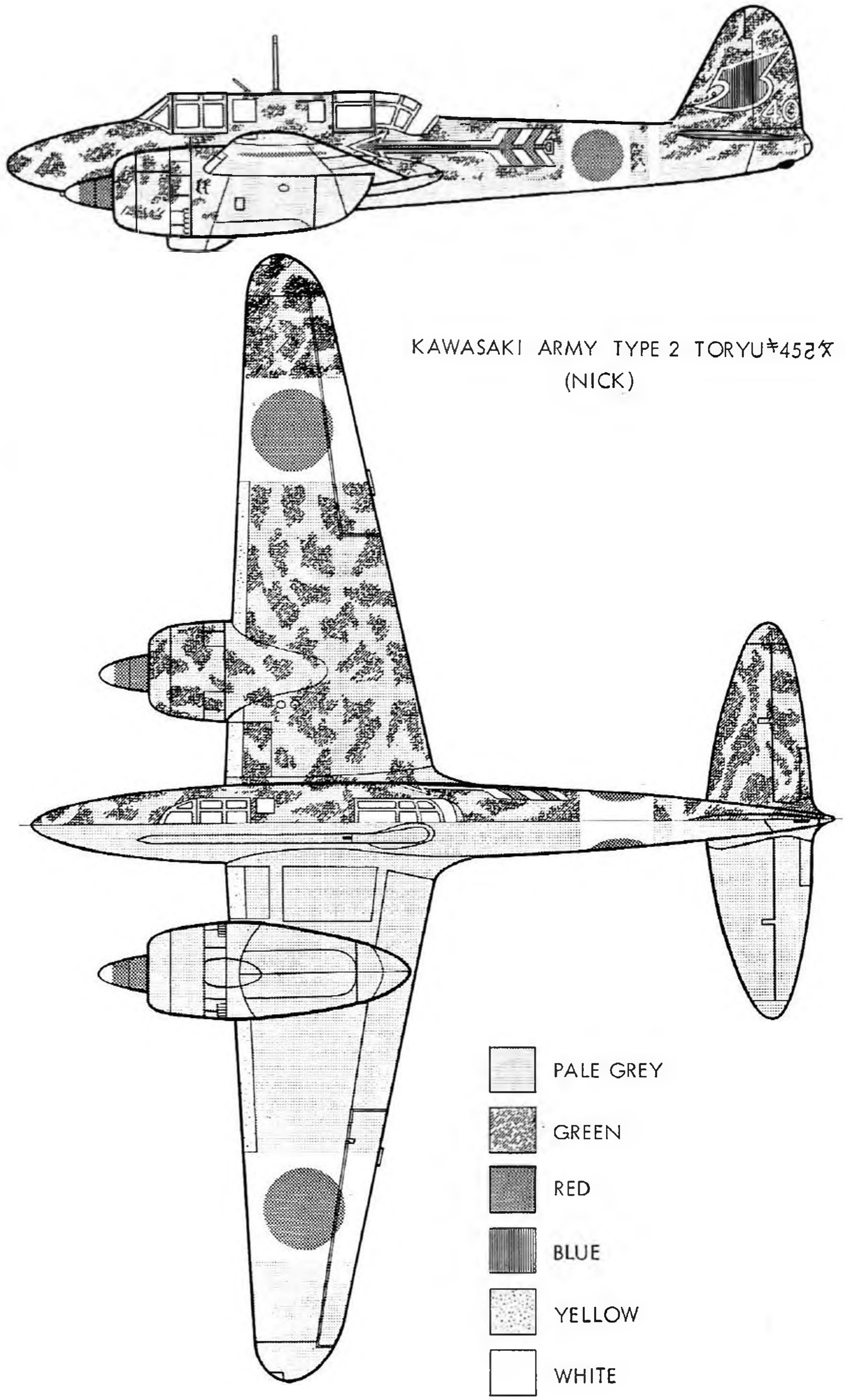
Aircraft captured by the British in Malaya retained their Japanese camouflage but carried pre-war type red white and blue British roundels with a yellow surround on the fuselage. They also had the initials of Allied Technical Air Intelligence Unit South East Asia crudely painted on the fuselage in white. The remains of this marking can be seen on the Zero in the Imperial War Museum. This aircraft has had a coating of matt brown applied, apparently with a whitewash brush, over its dark green camouflage.

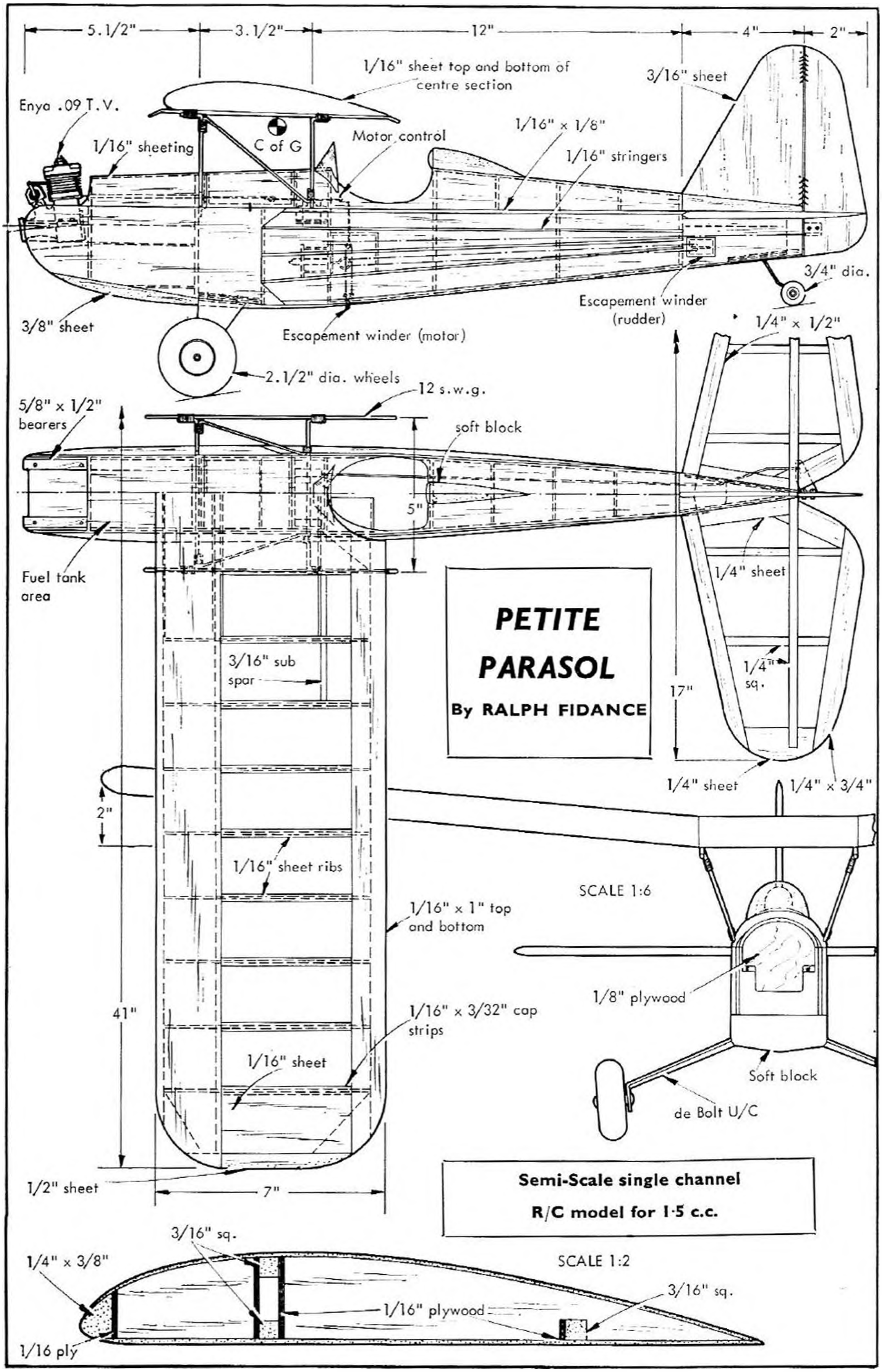
After the surrender Japanese transport aircraft continued to operate, for a while, with their original crews, under R.A.F. orders. These planes were painted white, with S.E.A.C. dark and light blue roundels. New names were painted on the nose in black letters about 18 in. high. Examples were a Ki 57 Topsy "1st Lt. Lynne Chute". A Tabby (DC 3) was "Fanny's Frolic" and another Topsy "W.A.A.F. Winsum".

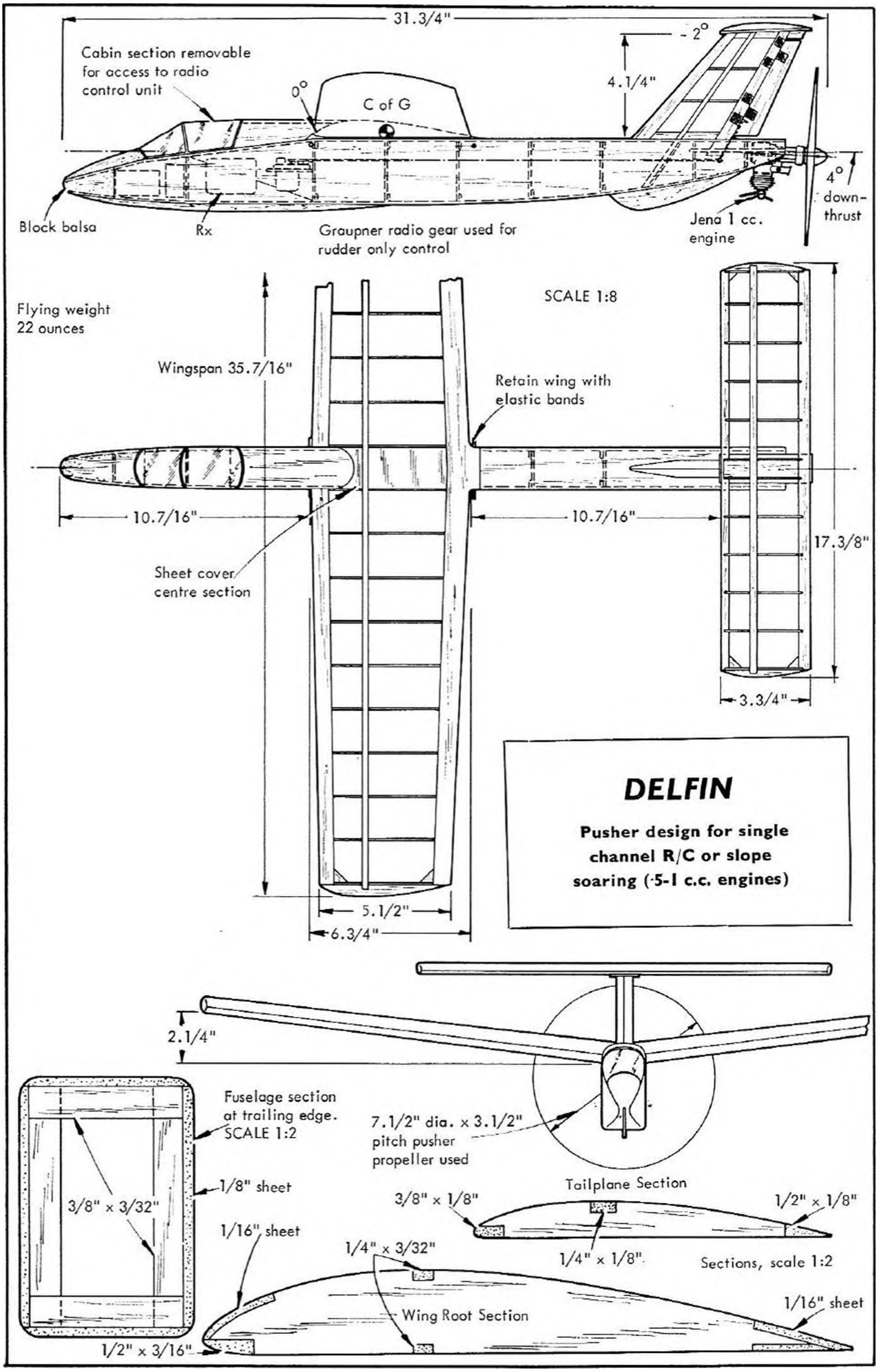
Examples of non-standard colouring found in Malaya at the end of the war were an Oscar, dark green on top, silver underneath and with yellow disc national markings. This aircraft probably belonged to the puppet Manchurian Air Force. A Ki 36 Ida was camouflaged with large rectangles of light green, olive green, dark brown and orange. This aircraft was silver underneath and had plain red roundels.

A Ki 56 Thelma (Lockheed Lodestar) was silver with large patches of matt green, so that from a distance it looked like a jig-saw.

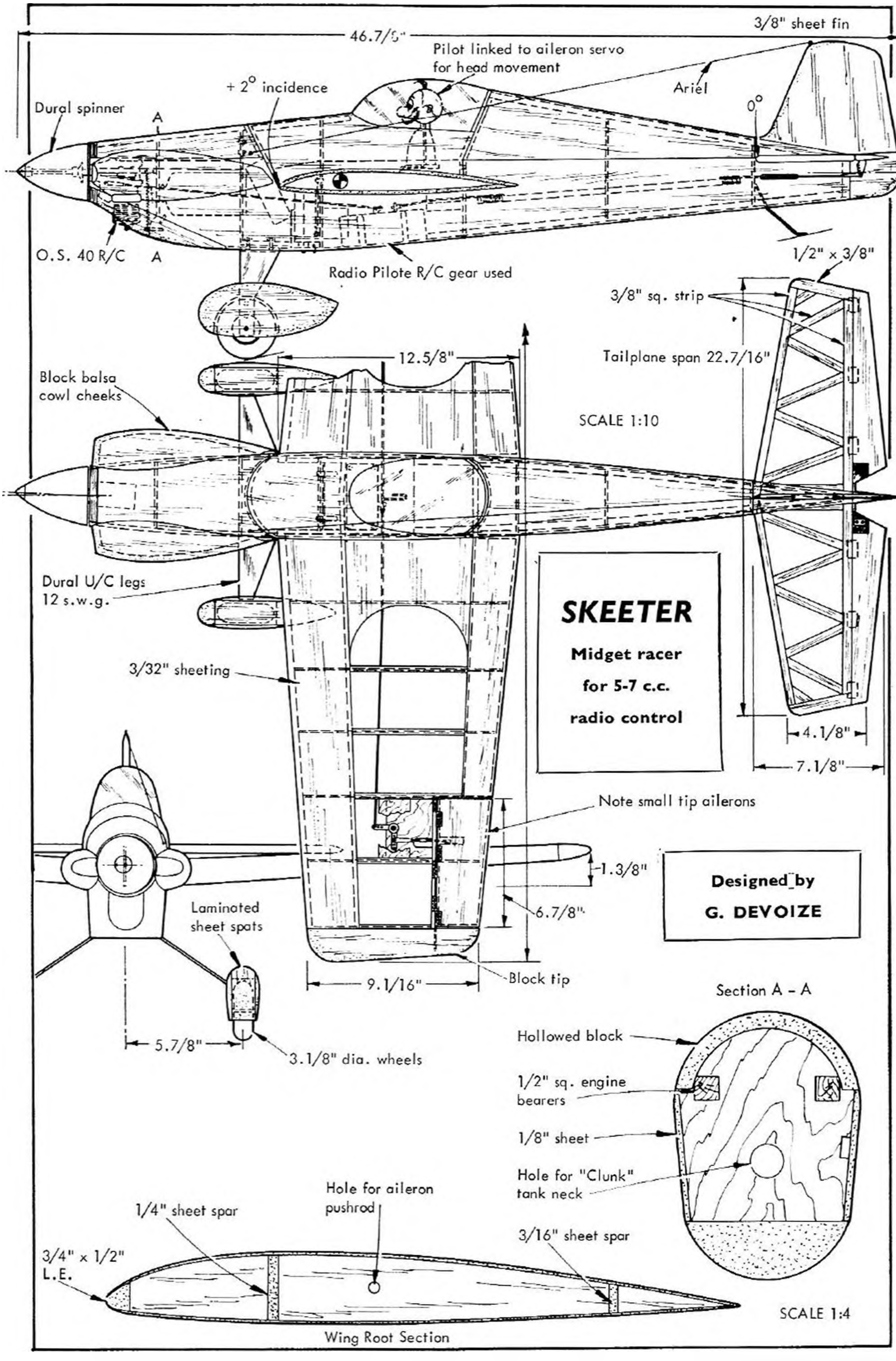
It is hoped that these notes will prove of some use to scale modellers, and perhaps also, to those building semi-scale models, which often look much better for an authentic bright colour scheme.


KAWASAKI ARMY TYPE 2 TORYU キ45改
(NICK)
4
PALE GREY
GREEN
RED
BLUE
YELLOW
WHITE


5.1/2"
3.1/2"
12"
4"
2"
1/16" sheet top and bottom of centre section
3/16" sheet
Enya .09 T.V.
1/16" sheeting
C of G
Motor control
1/16" x 1/8"
1/16" stringers
3/4" dia.
Escapement winder (rudder)
3/8" sheet
Escapement winder (motor)
1/4" x 1/2"
2.1/2" dia. wheels
12 s.w.g.
5/8" x 1/2" bearers
soft block
5"
Fuel tank area
1/4" sheet
PETITE PARASOL
By RALPH FIDANCE
3/16" sub spar
1/4" sq.
17"
1/4" sheet
1/4" x 3/4"
2"
1/16" sheet ribs
SCALE 1:6
1/16" x 1" top and bottom
1/8" plywood
41"
1/16" x 3/32" cap strips
1/16" sheet
Soft block
de Bolt U/C
1/2" sheet
7"
Semi-Scale single channel
R/C model for 1·5 c.c.
3/16" sq.
1/4" x 3/8"
SCALE 1:2
3/16" sq.
1/16" plywood
1/16 ply



MODELAR, CZECHOSLOVAKIA



AIR MODELES, FRANCE

CONTROL LINE FUEL TANKS

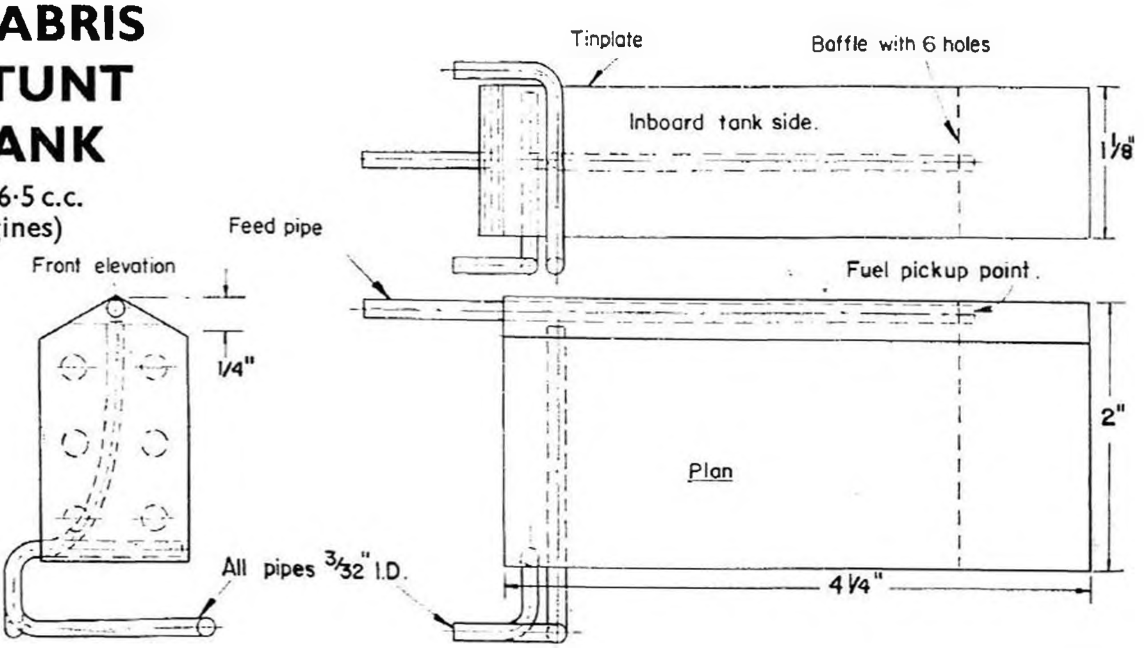
THE incorrect installation and design of fuel tanks has over the years caused trouble for thousands of modellers with starting the engine, fuel starvation, and flights where the tank gives a rich run to start and a lean ending.

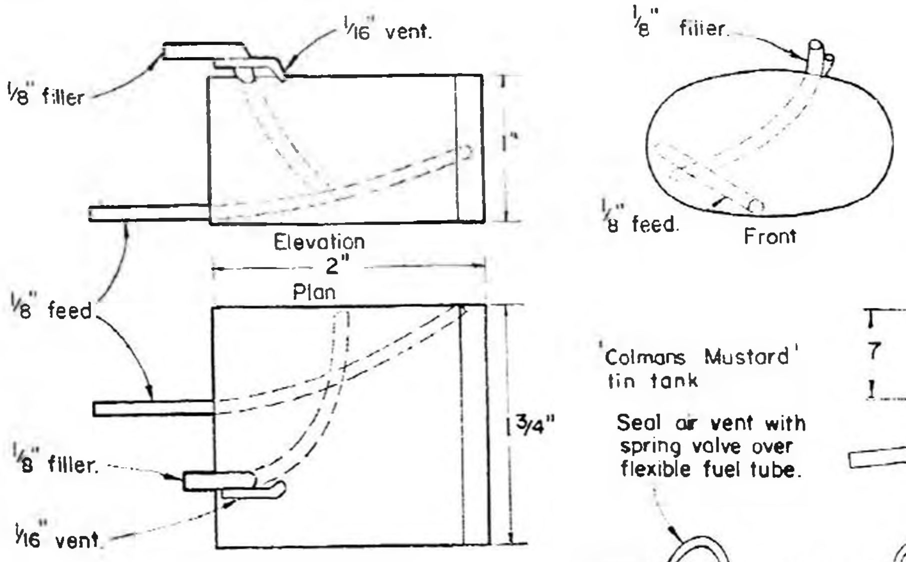
With careful design and some basic thinking, many of the problems can be overcome. We say many, as the reducing mass of fuel, hence weight, always causes a slight leaning of the fuel-to-air ratio. This can be partially controlled as explained later.

One of the *golden rules* is to mount the fuel tank symmetrically about the needle valve level. This is most important in an aerobatic model that is designed for sustained periods of inverted flight. In this case the head of fuel will be equal with the model flying in either direction and the motor run unaffected by a change in mixture strength. Should the fuel tank be mounted slightly above or below the needle valve it will run at the ground setting when flying level and will then richen up or lean out if the tank is mounted too low or high. The stunt tank illustrated is a design developed by Czechoslovakian, Josef Gabris the current *World Aerobatic Champion* and used in the A.P.S. Super Master. Note the fuel feed pipe, situated exactly on the centre line and the baffle to reduce the *surge* effect on the fuel induced by a sudden turn of the model. The original inspiration for this tank came from Bob Palmer whose tank designs are sold under the Veco trade name. The two vents are positioned to stop fuel coming out of them whatever the attitude, but at the same time to allow a passage-way to atmosphere, so the volume of fuel consumed by the engine can be re-placed. If this were not the case a partial vacuum would be created and the

GABRIS STUNT TANK

(5–6·5 c.c. engines)



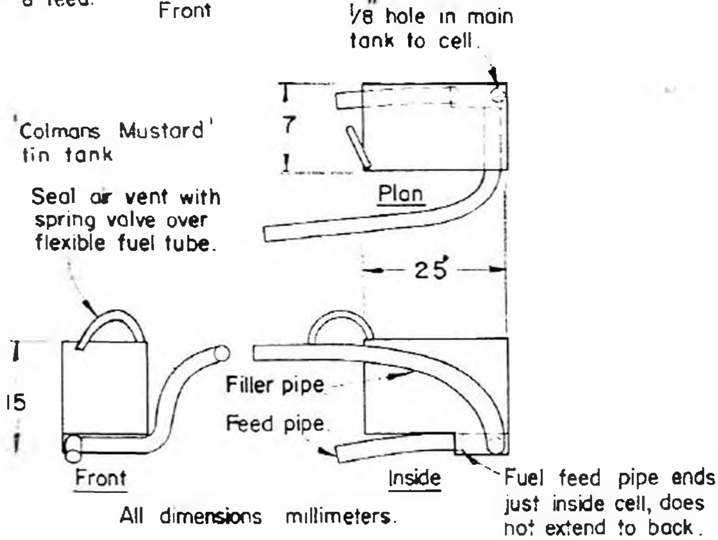


F.A.I. TEAM RACE TANK by D. Jehlik ▶

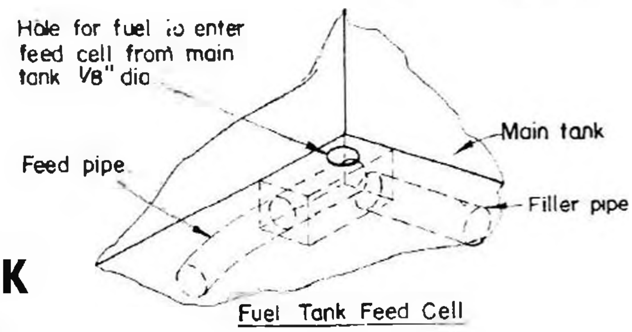
(2·5 c.c. engines)

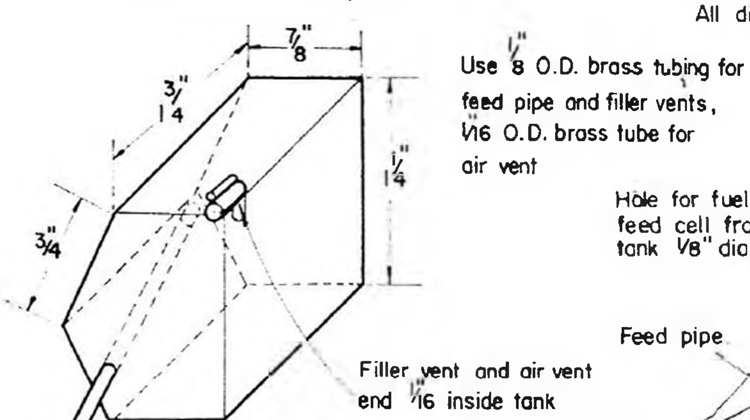
NORTHWOOD COMBAT ◀ TANK

(2·5 c.c. engines)



Jehlik Detail ▼

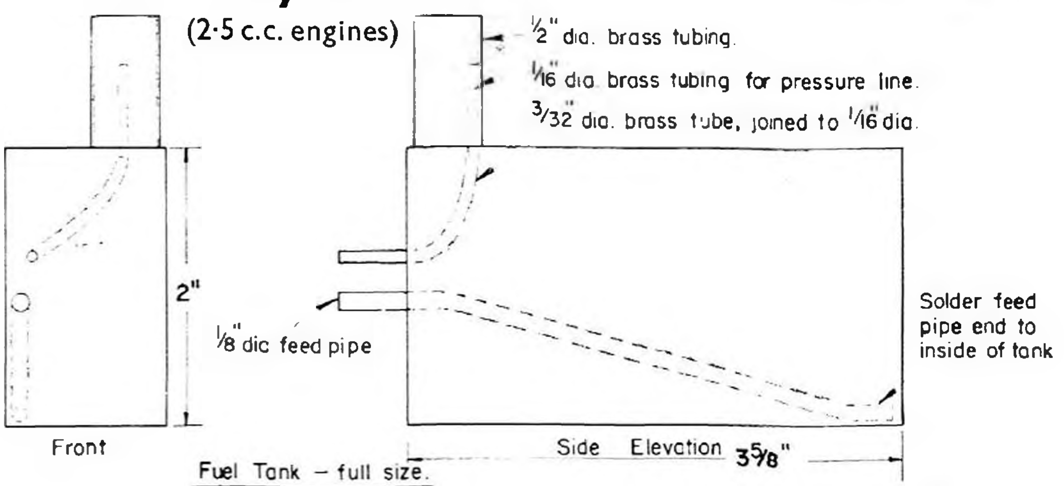




Tank Detail

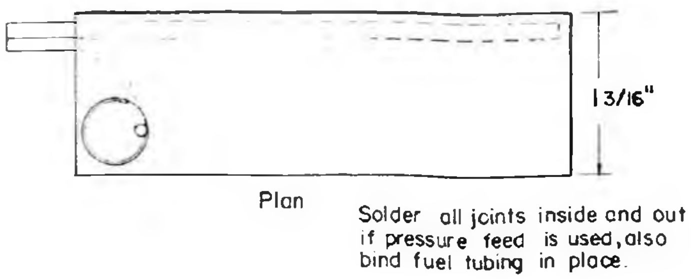
COMBAT TANK by M. Morris

(2·5 c.c. engines)



RAT RACE TANK by Don Burke

(5–6·5 c.c. engines)

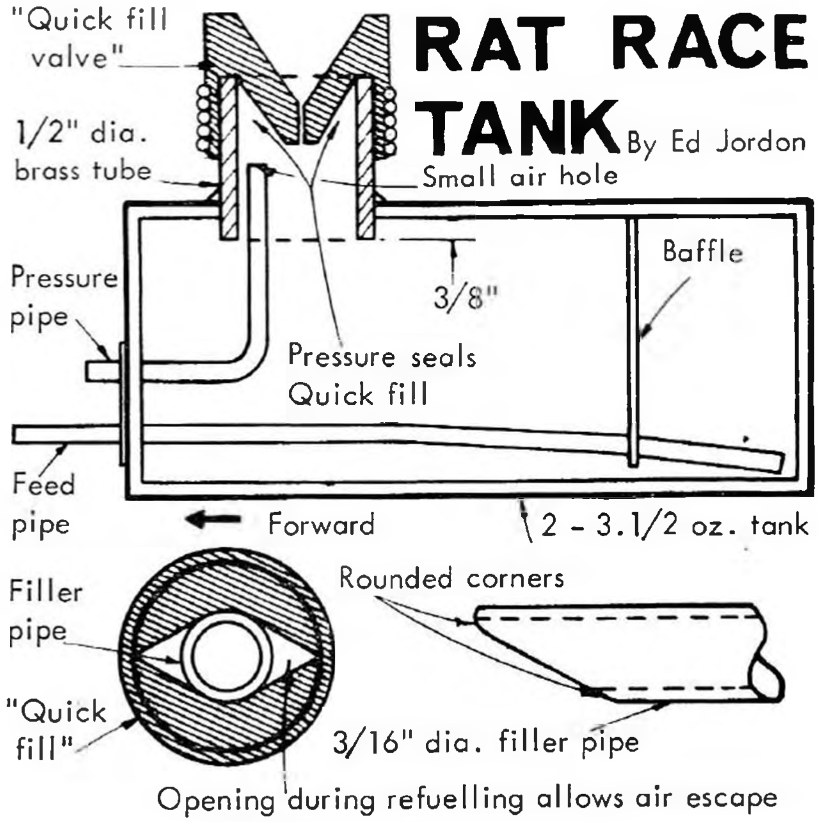


engine would cut, due to fuel starvation. When this tank is inverted, the fuel will seal the end of the vent pipe that reaches across the width of the tank and also cover the internal end of the other vent. Why does it not cut the engine then? This is a good question. The suction on the fuel is such that the air is pulled down the pipe in small volumes equal to that of the fuel consumed by the engine.

Positioning the internal end of the feed pipe a good distance from the rear end of the tank has the effect of giving a sharp engine cut, instead of the slow starving off that is present when the pipe is at the extreme rear collecting every droplet of foamy fuel left in the tank.

Combat models have a tank very similar to that of a stunt model, though usually smaller for the size of diesel engine used, when compared with the large glow engine used in most stunters. One of the most time-proven tanks is the *Northwood M.A.C.* "Colemans" Mustard tin type, used in such outstanding models as the *A.P.S. Razor Blade* and *Flingel Bunt*. This is constructed from the elliptical section Coleman's Mustard tin and has been proved to give a consistent run from a combat model that is gyrating all over the sky. The drawing illustrates how the filler pipe reaches to the outside edge of the tank while the smaller vent pipe only just breaks through the top surface of the tank. This does allow some fuel to escape, but it's of no consequence. Note again that the feed pipe is on the centre of the tank, the fuel will be forced up to this point by the gravity effect pushing it up the sloping tank section. The above does not mean that all tanks have to be this shape, rather that it's one of many that work well. The square edged type used in the *A.P.S. Turncoat* by "Moggs" Morris is also consistent and this has the two vent pipes extending into the tank as little as $\frac{1}{16}$ of an inch. Fuel may run, and be syphoned out by the propeller slipstream, but it seems to have little effect on performance. The shape is convenient for attaching to the side of a profile model fuselage, due to its large inboard face area.

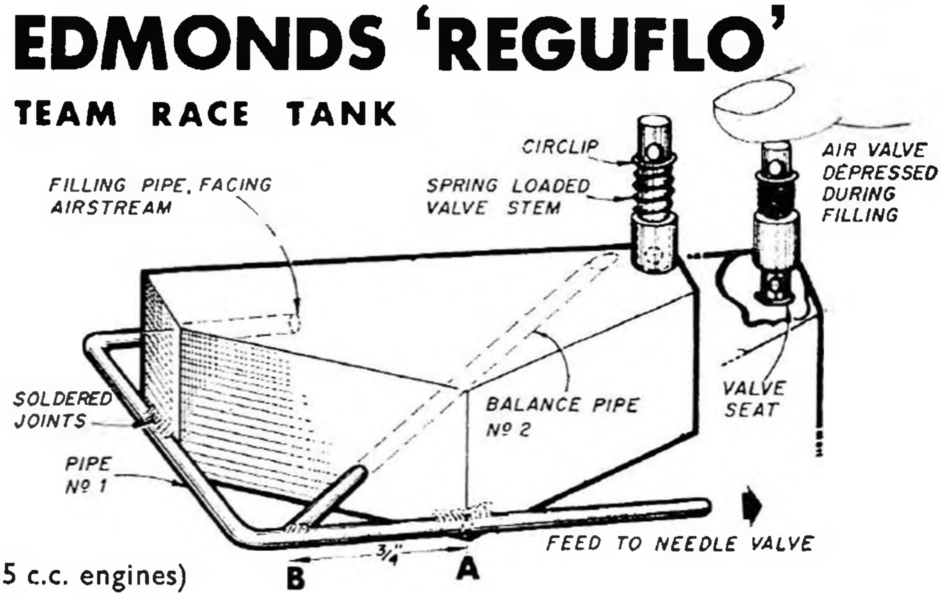
Speed models like team racers will *always* have a tank problem. The reason is that with speed the absolutely correct flow of fuel to the engine is needed, however maximum speed and uniform flow is only required for a short period of time, usually up to ten laps while the model is being timed. To achieve this the model is released with the engine running quite rich and the pilots skill determines when he commences his timed run by selecting the middle part of the engine run, so it gets the least of both the lean and rich run. This is not a great problem however, as the tank size is small and with pressurised systems whereby the piston acts as a pump forcing the crankcase to pressurise the fuel flow variation is less than with *straight* tanks, *i.e.* unpressurised. Pen bladders are also used as pressure tanks, to get a constant high pressure forcing the fuel through the engine, instead of the engine having to suck the fuel, thereby allowing in a larger cross section venturi intake. A fountain pen ink sac (bladder) is prepared by binding the neck to a tube. Sometimes this is surrounded by a small balloon to equalise external pressure. The bladder is filled with fuel from a graduated syringe. As soon as the engine fires the bladder is opened to the needle valve and the fuel is forced into the engine. This system is also used in combat models, but it's generally unreliable for this purpose. Another system of keeping an *almost* constant fuel supply is the "Chicken Hopper" tank. This principle, copied from the small header tanks that feed water to farm animals from a large bulk tank, is really a two cell tank. The



(5–6·5 c.c. engines)

engine runs on fuel drawn by suction from the small header tank, which is connected to the large main tank by a feed pipe and an air balance pipe, so that fuel is taken in to replace that which the engine has used only when the air balance pipe is uncovered, hence completing the cycle and allowing just enough fuel into the header to re-cover the air pipe. This cycle is continuous until the main tank is empty and the header drained. The same principle is also used extensively in team racing.

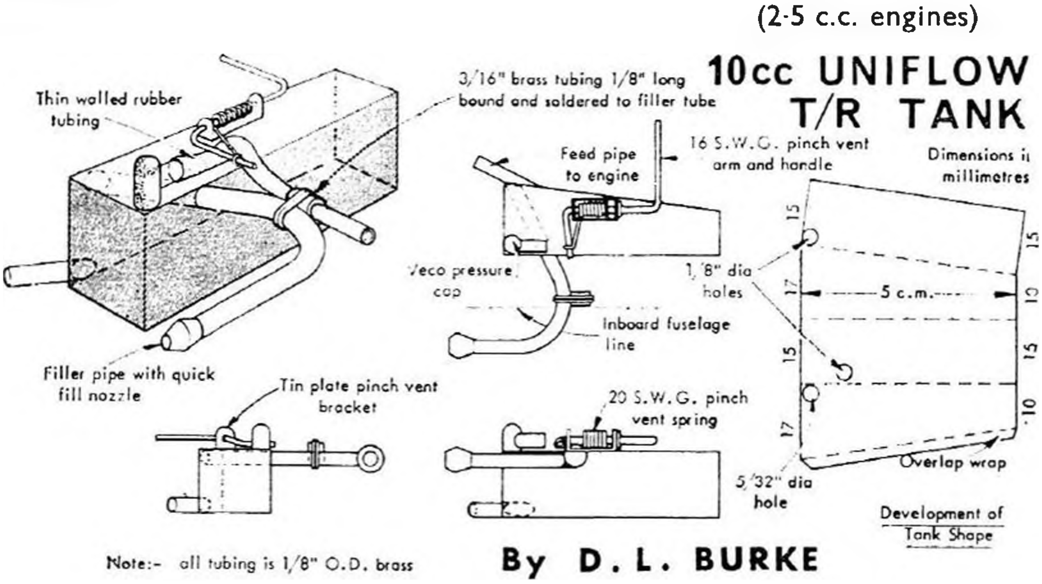
Another little known facet of tank *performance* is that of loss of fuel and fuel energy by the tank absorbing heat from the engine. Bill Wisniewski the F.A.I. class speed record holder and '66-'68 World Champion insulates his tanks with rubber and Brian Turner the team racing exponent uses balsa for the



(2·5 c.c. engines)

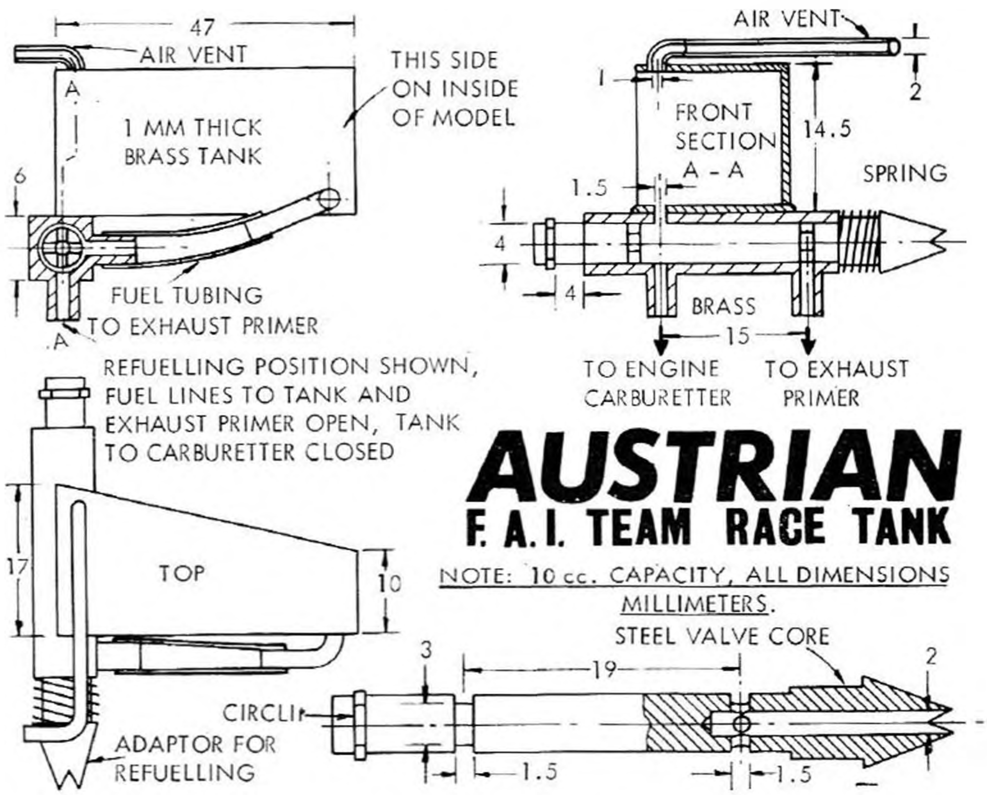
same effect. Balsa is in fact, a very good insulation material and is used for this purpose extensively in industry. A metal fuel tank fixed to a cast alloy speed or team race pan allows the fuel to absorb a large amount of heat and in team race, with evaporation this could be the cause of decreased lappage.

The tanks used in rat races are usually large ($2\frac{1}{2}$-$3\frac{1}{2}$ oz. capacity) and with pressurised fuel supply and self sealing "Quick Fill" valves they are quite simple. Soldering of the highest quality is essential due to the pressure build up and large side areas that can bow quite a lot if not supported. With all the components cut out and shaped it's advisable to solder all the joints inside and out, so when the components are finally soldered together the solder forms a bonding on the inside *and* outside faces. Always flush the tank out with a solvent or petrol before installation in a model as Bakers fluid is very corrosive and Flux paste can block a fuel line quite easily. To check for leaks block off all the vents, except one, then pressurise the tank with a squeeze bottle on the remaining vent, while the tank is totally immersed in *still* water. Any leaks will show up as air bubbles.



Tanks for team racers are highly critical in design to say the very least, and almost every possible system for obtaining a constant flow has been tried by someone. The Edmonds *Reguflo* Mk.I tank is basically a chicken hopper tank with a short length of fuel tubing acting as a *very* small header tank. The tank is the main fuel store as described for the chicken hopper tank and the header tank is the small length of tubing between the fuel pick up point (A) at the *apex* of the tank and the *air balance pipe* junction (B) that goes to the inside face of the main tank, which is sealed off with a depression valve. With the system full and the engine drawing fuel from the feed pipe, the fuel is supplied until the balance pipe hole (B) to the main tank is uncovered. When this uncovers the pipe permits a small amount of air into the main tank to release the partial vacuum and allows fuel to flow through the fuel pick up point at the apex of the tank (A) to re-cover the air balance hole since the fuel flows back up the pipe as more fuel is released than the engine requires, until the engine has used enough fuel to uncover the air balance hole the main tank remains sealed. This function is performed very rapidly as it does not take long for the engine to use a volume of fuel $\frac{1}{16}$ in. diam. $\times$ $\frac{3}{4}$ in. long! The plumbing required is quite complicated and requires a certain amount of skill. The Burke *Uniflow* tank is a far more simple affair, fuel only being released to the engine when a bead of air is pulled into the tank by the partial vacuum. This is the *Marriotte Bottle* principle and Edmonds tanks have now been modified to this layout, mainly for commercial viability rather than increased performance.

Many team race models use very long thin tanks, the two illustrated are identical in purpose with different filling valves. The idea of having the tank so thin is to reduce the effective head of fuel acting on the engine and get a more consistent engine run. Both work well and this is the simplest type of tank. Note the car valve and special bottle top for filling. Ball valves can be made at home by inserting a ballbearing into a snug fitting tube then pushing another tube inside this one so the ball sits on it, the bearing then being held in

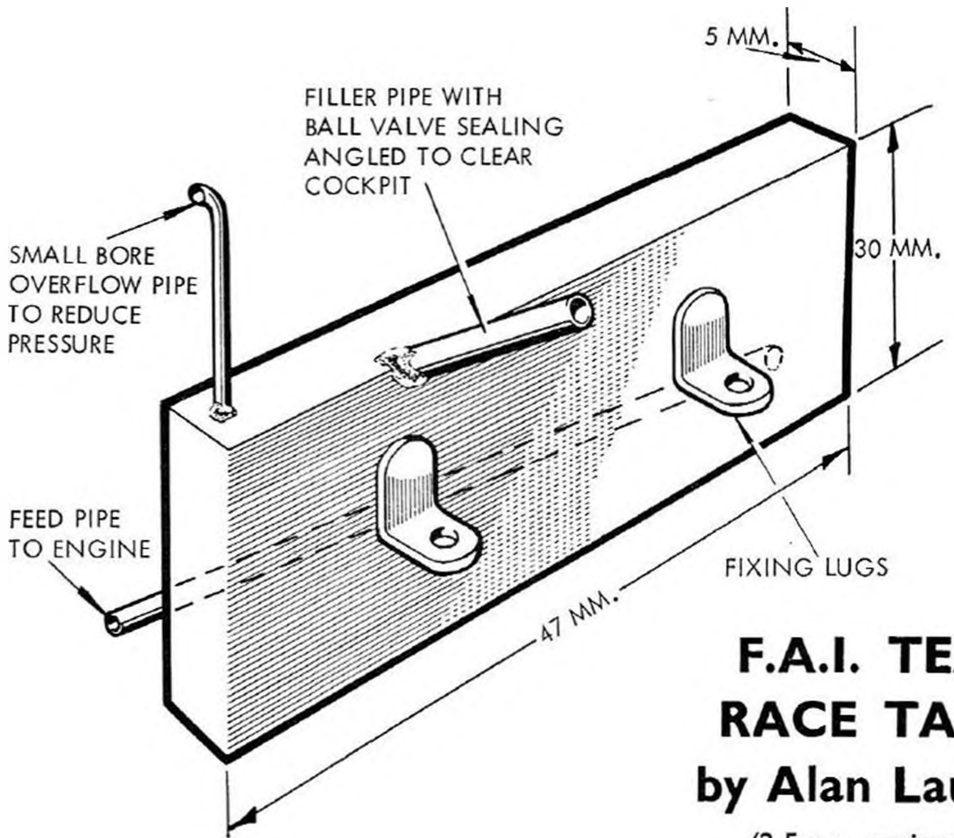


(2·5 c.c. engines)

place with a spring. To get the ballbearing seating just tap it with a hammer enough to punch its own seat. Car and scooter type valves can be Araldited into tubes for very cheap and practical valves.

Current *World Team Race Champions* Stockton and Jehlik use an almost square tank, that is yet another variation on the constant feed theme. A small cell underneath the tank acts as a header and this has the filler and feed pipe in it, the filler acting as an air vent as the main tank is sealed off with a pinch valve inside the fuselage.

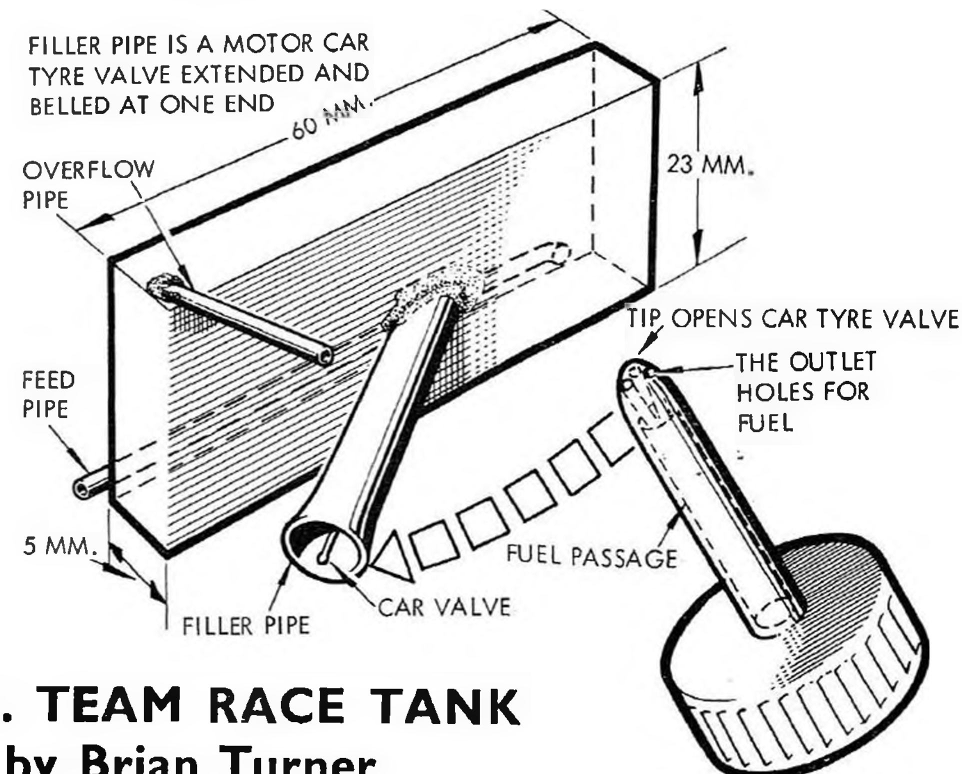
There have been all shapes imaginable to use every last drop of fuel, even a tank mounted *around* an Oliver Tiger front housing, about the worst possible place for heat! Positioning of the tank is very important for racing, not so much vertically as horizontally. It's best to get it as near as possible to the engine then move it sideways on the field until the position is established so that the engine will run a little rich on the ground then lean out after take off. Engines set too lean are the major cause of cutting on take off, baffles in the tank help a



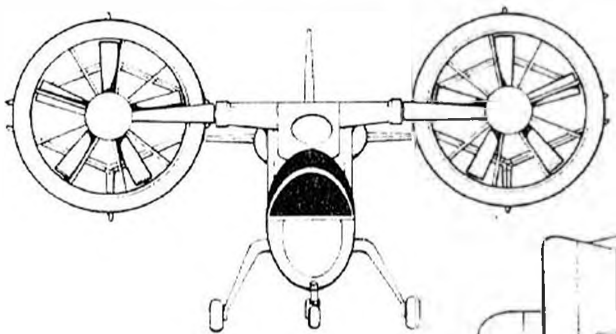
F.A.I. TEAM RACE TANK
by Alan Laurie
(2·5 c.c. engines)

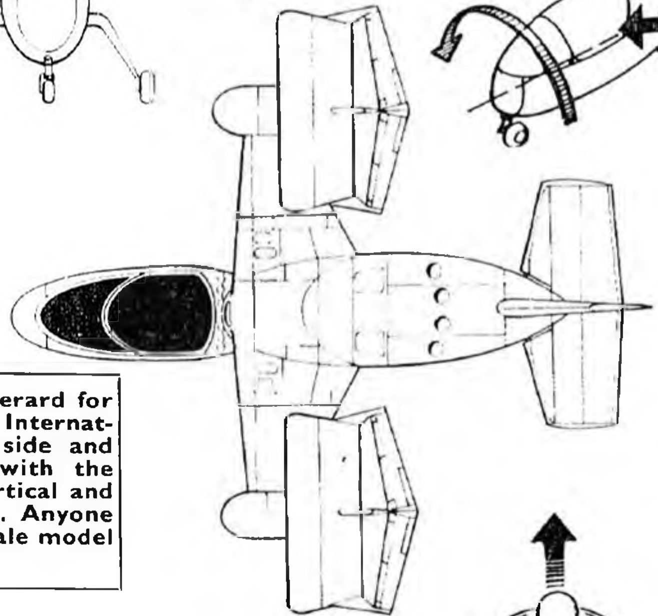
great deal to prevent this; but nothing can stop the engine "unloading" and increasing its r.p.m. on take off and hence requiring slightly more fuel as the engine will be consuming more air at higher r.p.m.

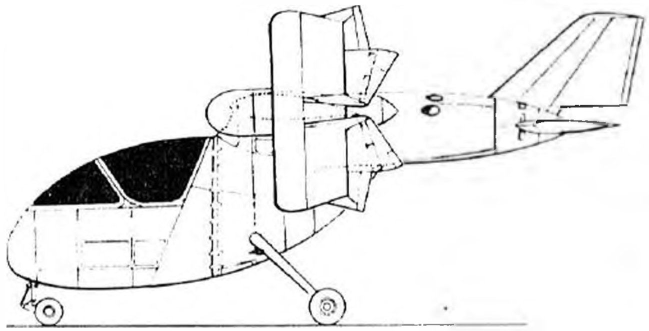
Anyone who can develop a tank to give a *perfectly* constant run from start to finish will be a very popular individual!



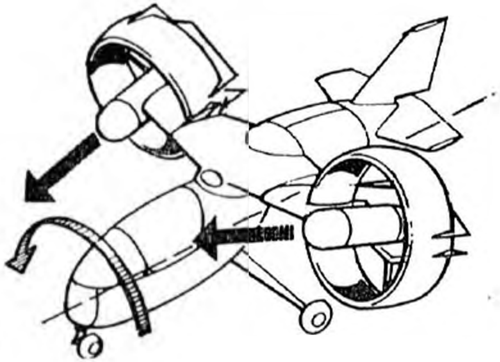
F.A.I. TEAM RACE TANK
by Brian Turner
(2·5 c.c. engines)

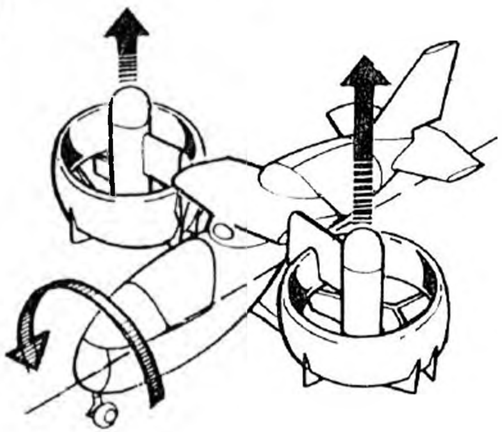




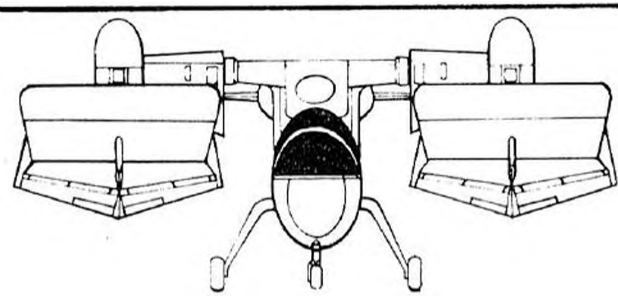


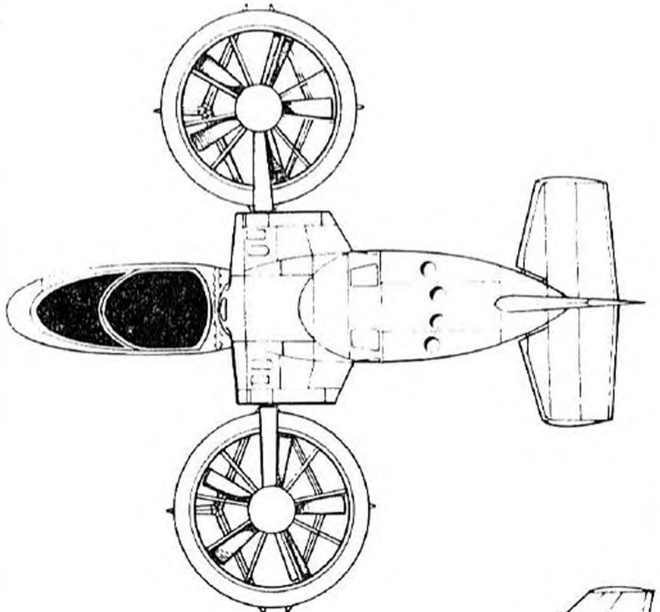
Drawings by Jean Perard for ' Aviation Magazine International'' show plan, side and frontal elevations with the ducted blades in vertical and horizontal attitudes. Anyone care to attempt a scale model project?

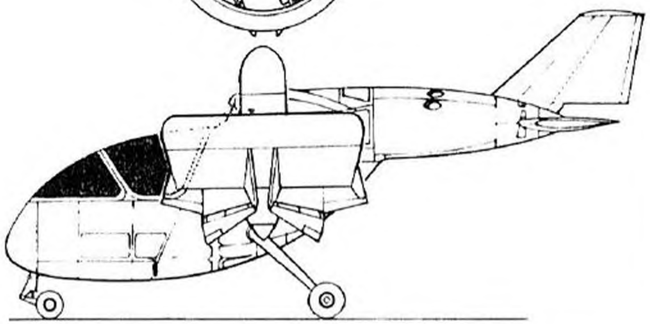




Above and Below are Jean Perard sketches of the 500 as they appeared in Aviation Magazine International to illustrate variable control through duct angles.







Cover subject—a glimpse into the future?

NORD 500

THE ducted fan type of airscrew is by no means new—indeed in the early years of aviation it seemed likely to be the ultimate line of development.

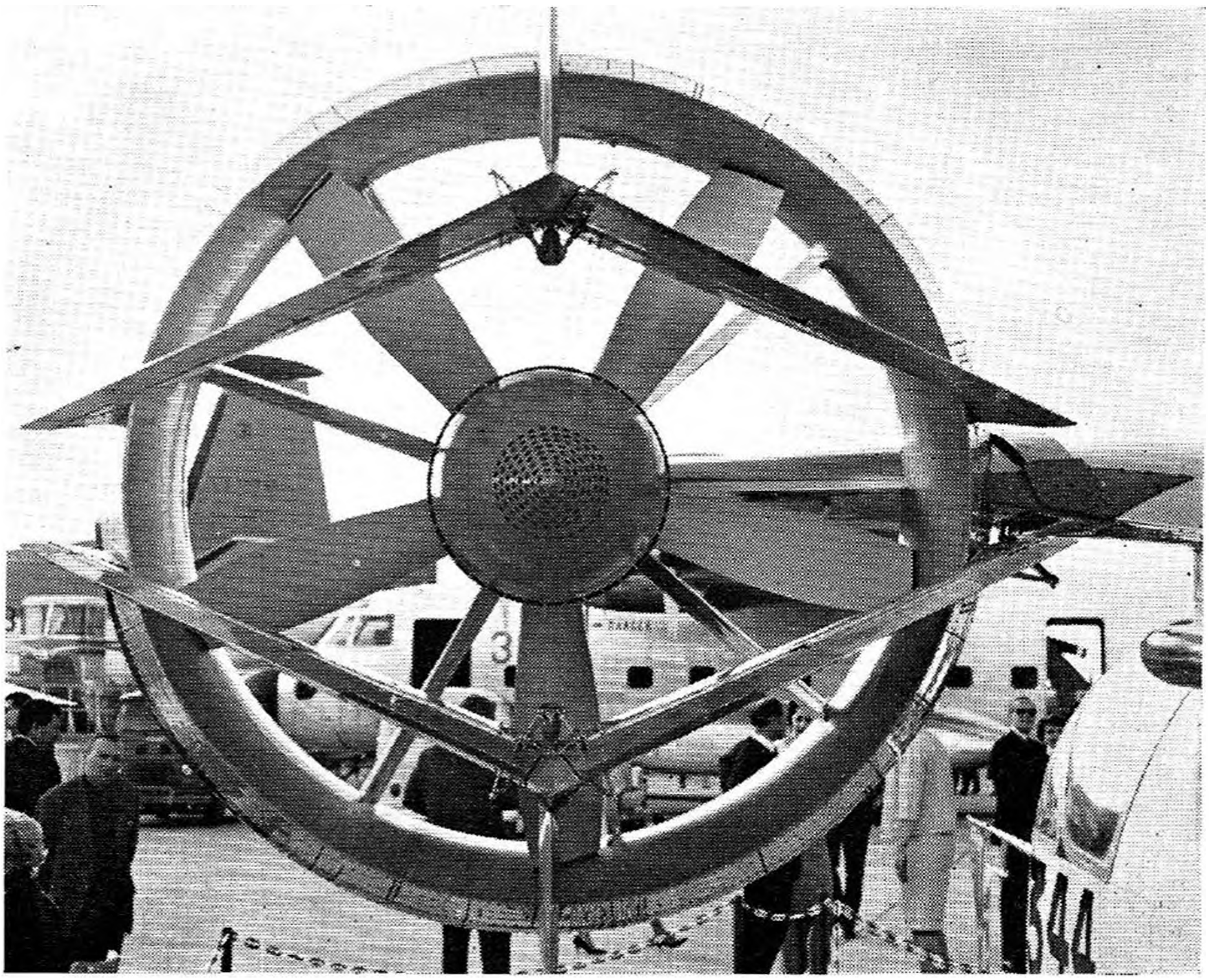
Nord-Aviation has been running a Ducted Fan Airscrew division since 1958 under the control of Chief Engineer Soulez-La-Riviere, and this department has been responsible for the development of the Nord 500 which was first exhibited at the Paris Show in 1965. In association with Nord Aviation have been

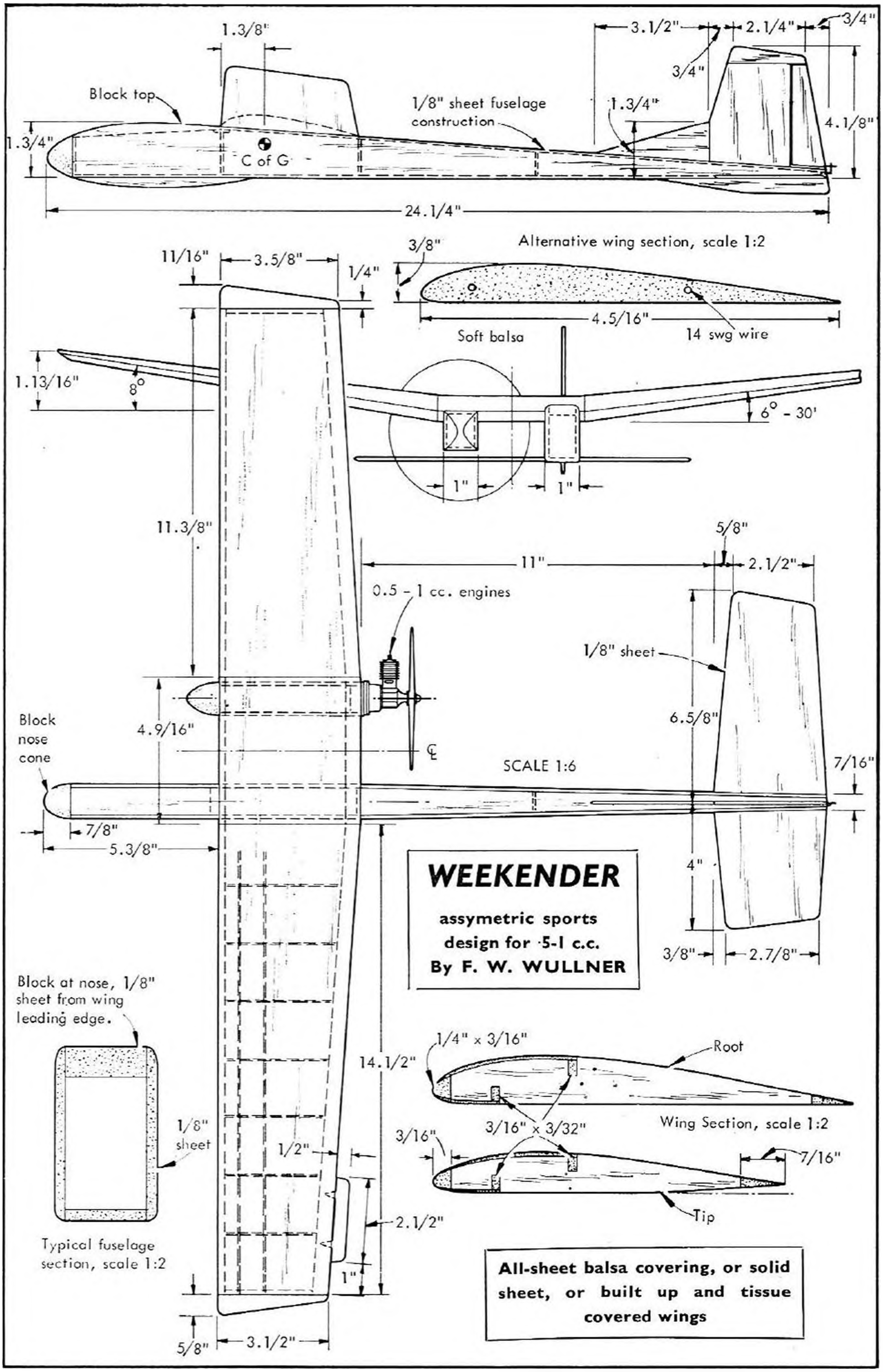
the Bertin company, who have also been obtaining interesting results since 1962. The idea of the shrouded propeller has been allied to variable geometry which seemed most likely to provide a satisfactory answer at low cost.

The annular ring enclosing the airscrew permits it to be controlled by movements in all directions and both by changing the direction of the air flow and altering its dimensions. The Nord 500 has two airscrews, one on each side, located at the ends of the high stub wings. These units can be operated independently through a wide range of angles to achieve all kinds of manoeuvres, including nearly vertical take-off, normal forward flight, sharp turns in either direction, many aerobatic evolutions, plus landing in restricted areas at slow speeds.

The Nord 500 is an experimental single-seater machine, later projects such as the 501 will carry two pilots and six or more passengers. The pilot sits in a cockpit below the airscrews with excellent visibility. He can if necessary eject by means of his Martin-Baker seat. Controls combine the normal functions of a conventional aircraft with those of a helicopter.

Total span of the prototype is 20 ft., length 21 ft. 7 in. Each rotorduct is 6 ft. 7 in. outboard, has an outside diameter of 6 ft. 9½ in. and inside diameter of 5 ft. 1¾ in. The tricycle undercarriage is fixed. A fin and elevator at the rear are locked in place and used only on landing. Elevator span is 8 ft. 2 in. Construction is semi-monocoque. Two Allison 250-C18 turbomotors of 250 h.p. each provide motive power. The intricate relay gearing is of Hispano-Suiza construction.





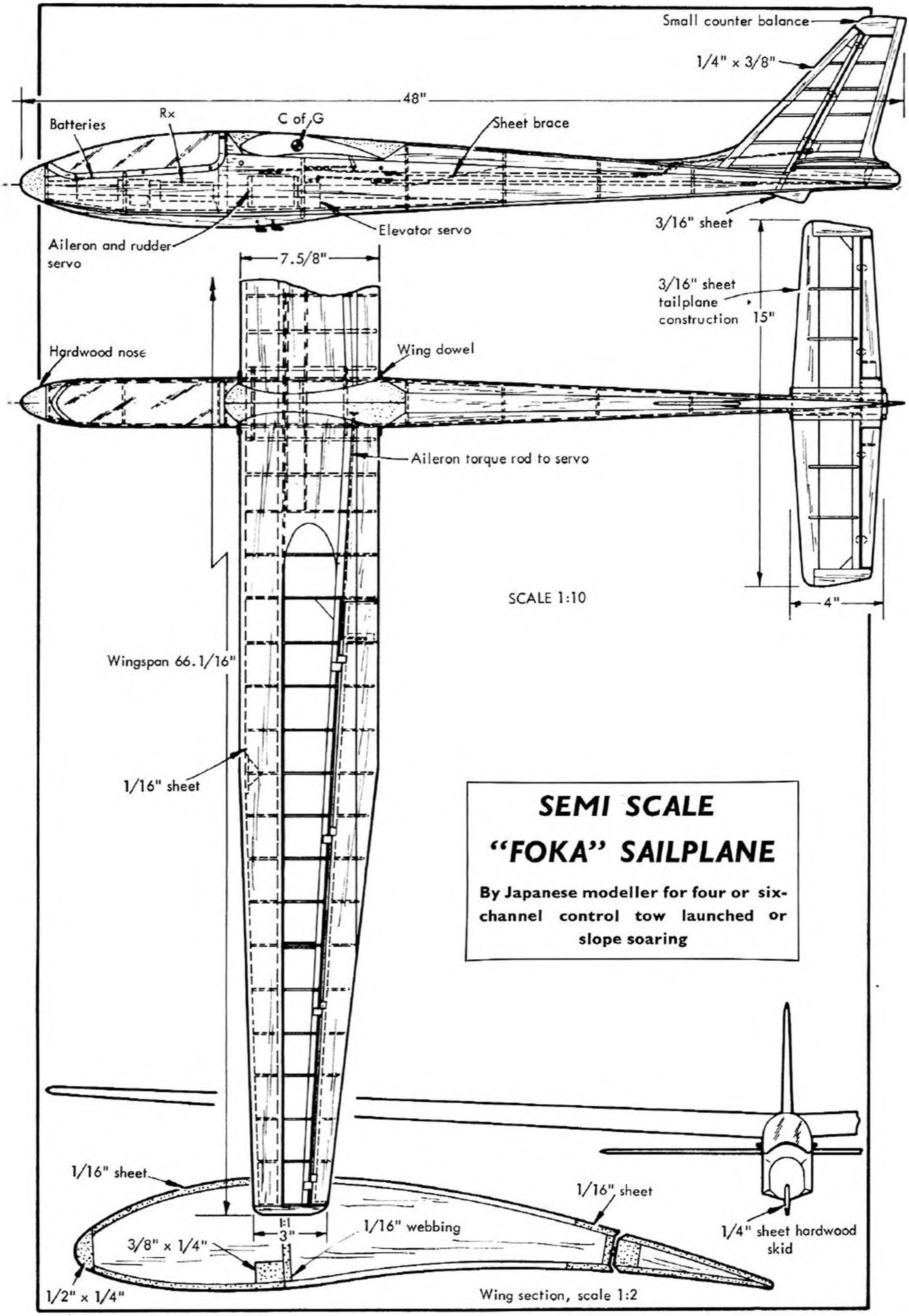
WEEKENDER

assymetric sports design for ·5-1 c.c.

By F. W. WULLNER

All-sheet balsa covering, or solid sheet, or built up and tissue covered wings

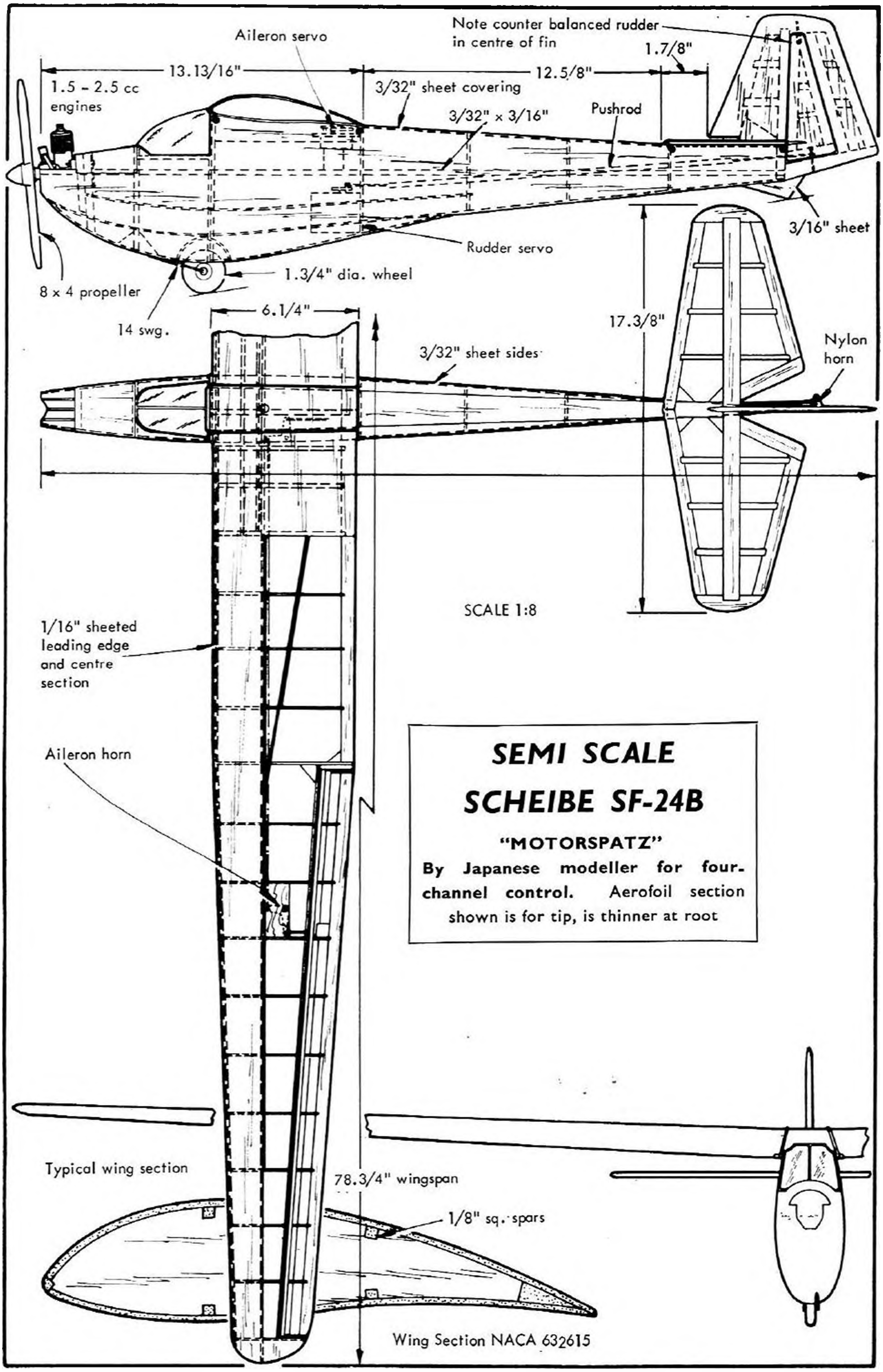
FLUG & MODELLTECHNIK, W. GERMANY



SEMI SCALE "FOKA" SAILPLANE

By Japanese modeller for four or six-channel control tow launched or slope soaring

RADIO CONTROL TECHNIQUE, JAPAN

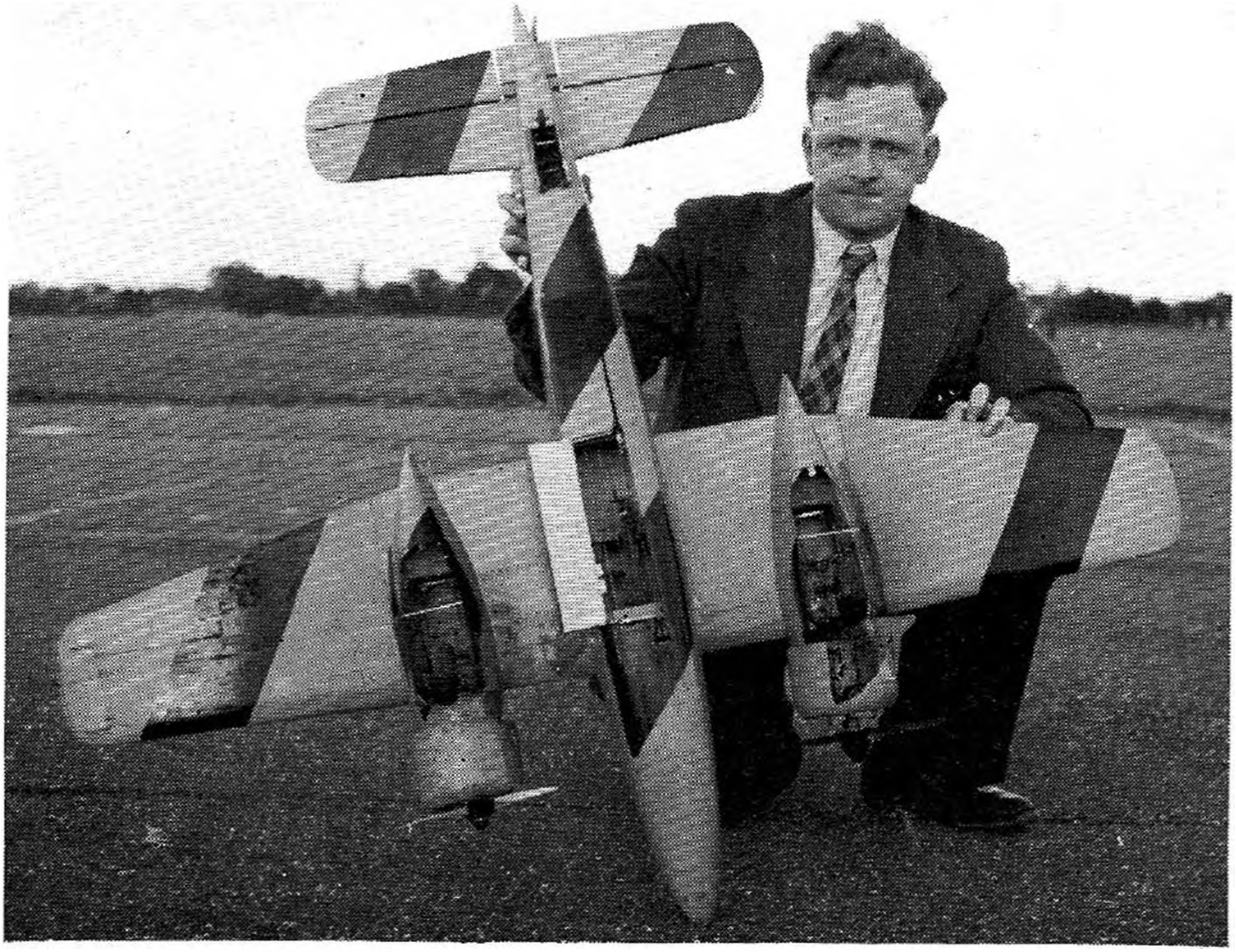


SEMI SCALE SCHEIBE SF-24B

"MOTORSPATZ"

By Japanese modeller for four-channel control. Aerofoil section shown is for tip, is thinner at root

RADIO CONTROL TECHNIQUE, JAPAN



Author D. Marsh poses with his miles Monitor. This shows U/C doors open and U/C in down position. Inspection door in fuselage is also open.

RETRACTING UNDERCARRIAGE FOR MILES MONITOR

by Doug Marsh

THIS model was built to $\frac{1}{12}$th scale, as an experiment for twin-engined *free flight*. The system used was similar to that used by other experimenters. The engine mountings were in slides and interconnected to each other by a bell crank which operated the rudder giving correcting turn for variation of thrust from the engines.

A retracting U/C, both main and tail wheels, was incorporated from the start. Originally this was operated by a small clock, modified using a vane air governor. This gave very realistic retraction, but was rather heavy and when the mainspring broke in the clock, the system was scrapped and the simple system described was fitted. Also the original idea of free flight was abandoned as the model was excessively heavy and underpowered with two Mills 0·75 c.c. and even when two 1 c.c. Spitfires were tried!

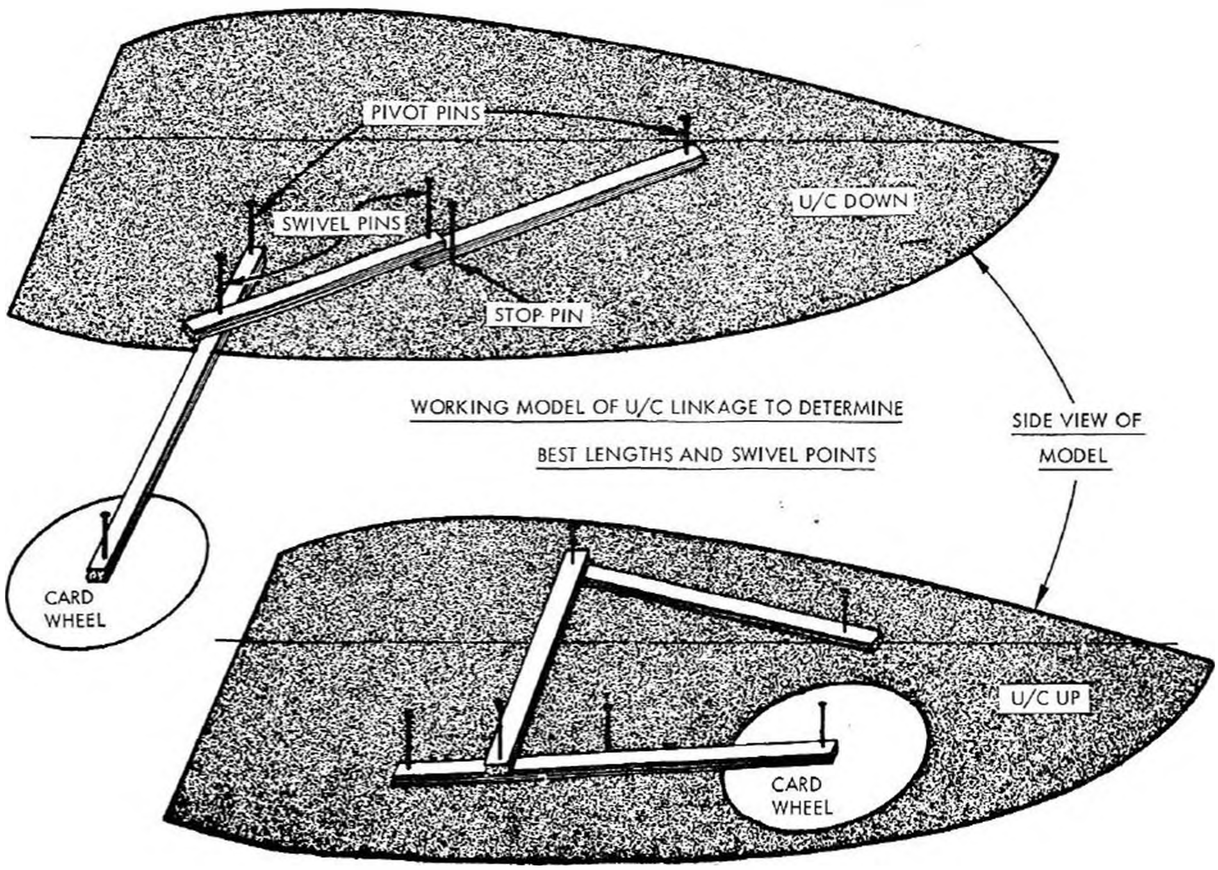
A pair of E.D. 2·46 c.c. Racers were fitted and the model modified for control line. The U/C was retracted automatically by a trailing whisker, which swung forward on take-off and knocked off a catch releasing the gear that retracted the U/C.

The U/C could be brought down and locked by pulling on a third line, prior to landing, usually after one engine had cut. The basic system could be easily modified to suit any particular installation. Trouble was experienced trying to design the actual retraction linkage on the U/C, this was overcome by making a working model using pins and strips of scrap balsawood and a circle of cardboard to represent the wheel. These were pinned to a side view of the model and various lengths and positions of pivot points tried out to get the desired movement.

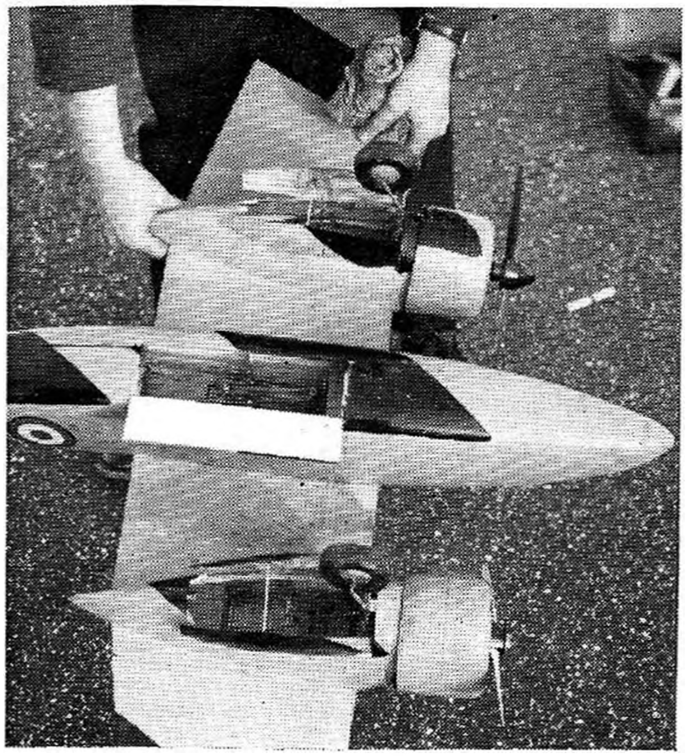
Description of Retractable Undercarriage (*see sketch, page 81*)

The two mainwheel U/C's were operated by a torque tube (1) made from two pieces of 10g. bore brass tubing passing through into the fuselage and fitted with an operating arm (2) of 14g. wire. The two tubes were sweated together and the operating arm, by a piece of tinplate (3) wrapped around the tubes, bound with fuse wire. The tubes (1) were supported in three bearings (4) made from brass strips firmly bound and cemented to the rear centre section main spar. The operating arm (2) had a small wire arm from 16g. (5) soldered to it at a suitable point for operating the tail wheel with a push-pull rod, (6) made from 16g. wire. Perhaps $\frac{1}{4}$ in. square hard balsa with wire bound to the ends would have been better as it is in compression when the tail wheel is down. For bearings on the end of the push-pull rod (6), 4 B.A. solder tags were used, the large hole end being wrapped round the wire and soldered, the small hole end being used as the bearing.

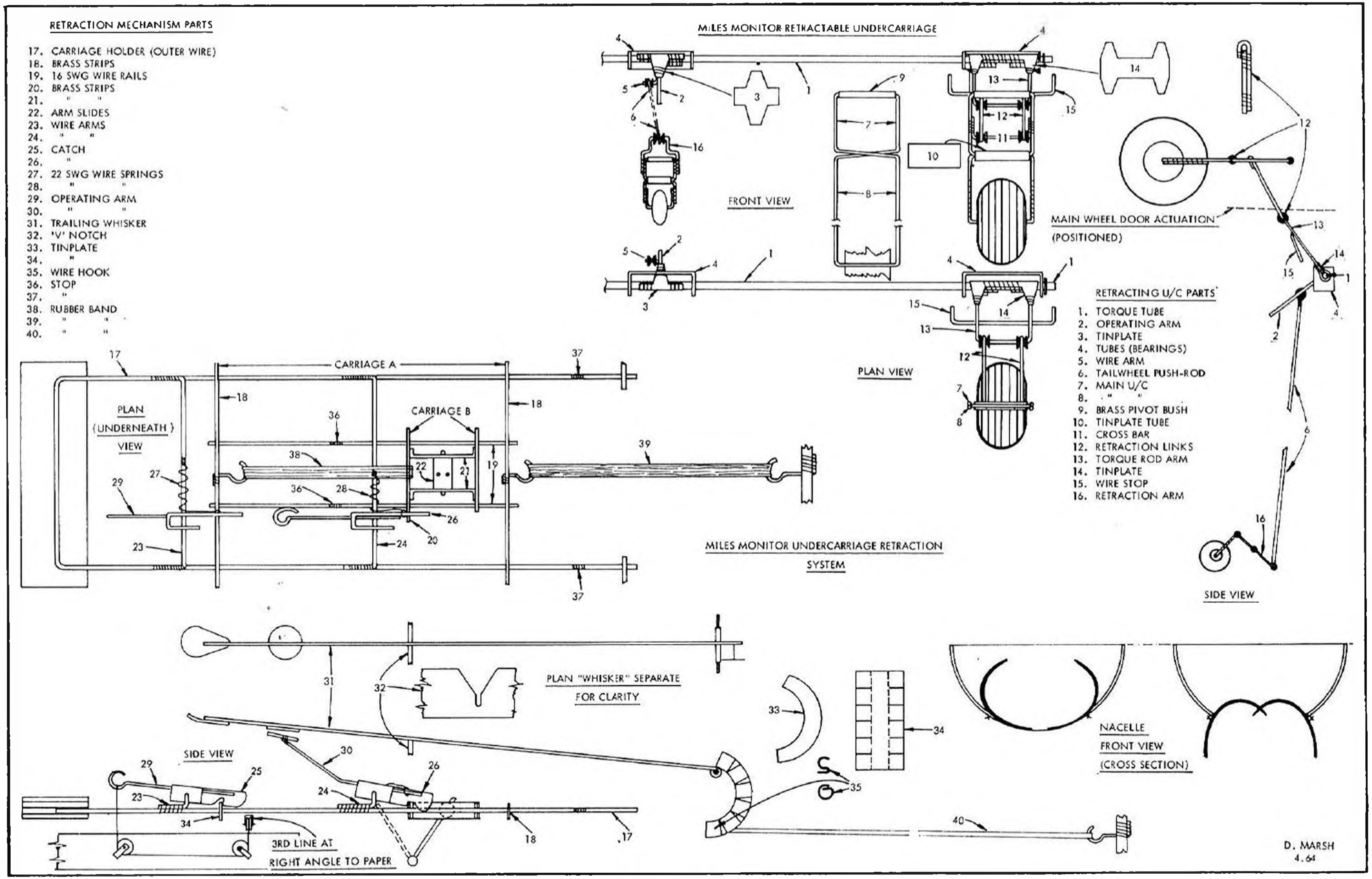
The main U/C leg was made from two pieces of 14g. wire (7) and (8). (7) was bent complete with its brass pivot bush (9) which was firmly bound and cemented to a former in the engine nacelle. (7) was criss-crossed over to give torsion bar springing, this part being enclosed by a tinplate tube (10) rolled



D. Marsh shows the model (control line version) with U/C retracted. Below is another shot with wheels down and fuselage bay open.



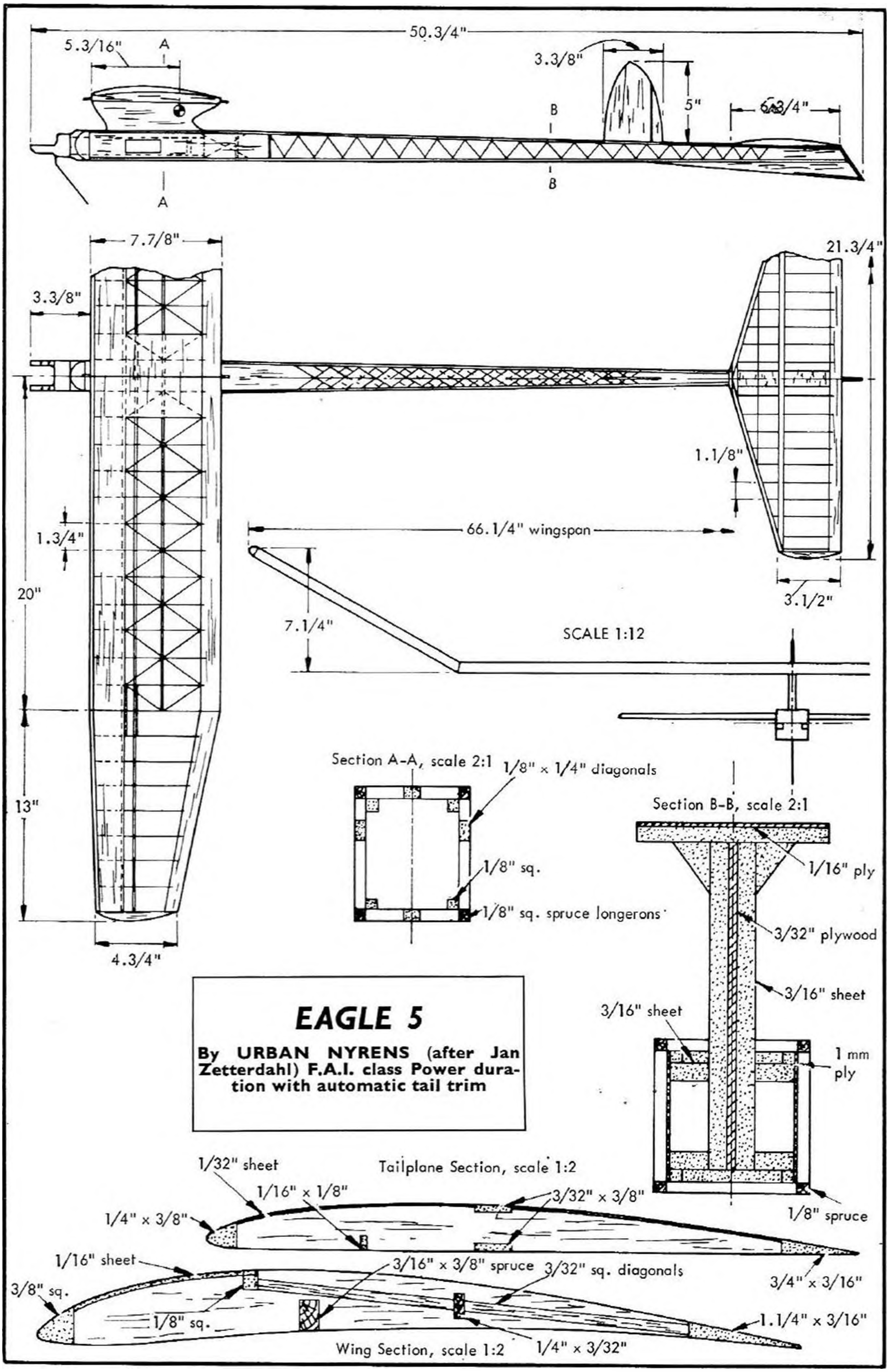
around it and soldered after bending (7). (8) was U-shaped bent with the wheel assembled on it then bound and soldered to the ends of (7). Another U-shaped piece of 16g. wire (11) was soldered to the main legs to form a pivot for the retraction links (12), two of these links per assembly were required, they were made from two pieces of 18g. wire. One piece had the ends bent to a U-shape, a straight piece with ends filed flat to the correct length, bound and soldered as shown in sketch, serving also to stiffen the links. The torque rod arm (13) was 16g. wire bound and soldered to torque rod (1) by pieces of tinplate (14) wrapped around and wrapped with fuse wire. Wire stop (15) of 16g. was bound to the side frames of the engine nacelle, this was positioned so that the pivot points of the retractor links and torque rod arm were out of line, so backward movement of the main legs, would not collapse the U/C. They also served as limit stops for the main U/C legs in the "up" position. The tailwheel was constructed similarly to the main wheels except the main legs were bent at right angles at the torsion bars, 18g. wire being used. A retraction arm also 18g. (16) was bound to the main legs, to which the push rod (6) was pivoted. It was found that even with the heavy torque tube (1) used, the weight of conventional 2½ in. diam. sorbo wheels was too much and the U/C hung down, only partially retracted. Lightweight airwheels or papier mâché as used on the model (made from newspaper and flour paste on a wood mould in two halves) were the answer. The nacelles are best made from glass fibre, although for cheapness, cotton bandage soaked in balsa cement was used on the model. The U/C doors were retracted by suitably placed U-shaped pieces of


RETRACTION MECHANISM PARTS
17. CARRIAGE HOLDER (OUTER WIRE)
18. BRASS STRIPS
19. 16 SWG WIRE RAILS
20. BRASS STRIPS
21. " "
22. ARM SLIDES
23. WIRE ARMS
24. " "
25. CATCH
26. "
27. 22 SWG WIRE SPRINGS
28. " "
29. OPERATING ARM
30. " "
31. TRAILING WHISKER
32. 'V' NOTCH
33. TINPLATE
34. "
35. WIRE HOOK
36. STOP
37. "
38. RUBBER BAND
39. " "
40. " "
MILES MONITOR RETRACTABLE UNDERCARRIAGE
FRONT VIEW
PLAN VIEW
MAIN WHEEL DOOR ACTUATION
(POSITIONED)
RETRACTING U/C PARTS
1. TORQUE TUBE
2. OPERATING ARM
3. TINPLATE
4. TUBES (BEARINGS)
5. WIRE ARM
6. TAILWHEEL PUSH-ROD
7. MAIN U/C
8. " "
9. BRASS PIVOT BUSH
10. TINPLATE TUBE
11. CROSS BAR
12. RETRACTION LINKS
13. TORQUE ROD ARM
14. TINPLATE
15. WIRE STOP
16. RETRACTION ARM
SIDE VIEW
CARRIAGE A
CARRIAGE B
PLAN (UNDERNEATH) VIEW
MILES MONITOR UNDERCARRIAGE RETRACTION SYSTEM
PLAN "WHISKER" SEPARATE FOR CLARITY
SIDE VIEW
3RD LINE AT RIGHT ANGLE TO PAPER
NACELLE FRONT VIEW (CROSS SECTION)
D. MARSH
4.64

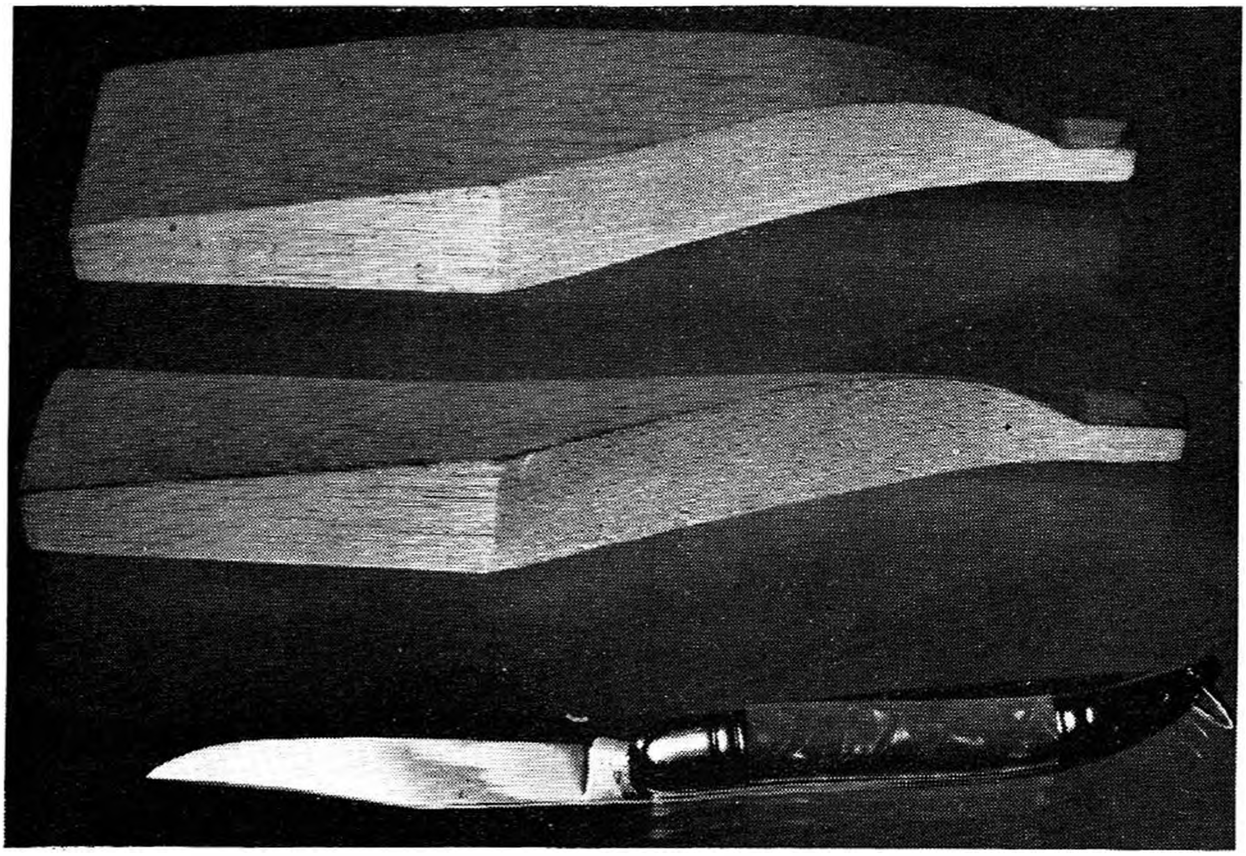
wire attached inside the doors as shown in the sketch, the U/C legs, striking on these wires and closing the doors over the U/C.

Description of Retraction Mechanism

This was made in a unit which could easily be detached from the model for adjustment. The two ends of the outer wire (17) slid into two $\frac{1}{16}$ in. ply reinforced holes on a suitable former in the model. The front end fitted into a piece of $\frac{1}{8}$ in. ply notched to receive it, firmly glued to another former in the fuselage. Another piece of $\frac{1}{8}$ in. ply was held on by two wood screws, firmly clamping the unit in the model. Wire (17) was bent from 16g. wire, carriage A slid on this, it was made from two strips $\frac{1}{4}$ in. $\times$ 18g. brass strip (18), with 16g. wire rails (19) soldered to them. Carriage B slid on wire rails (19) and was constructed of brass strips (20) and (21), with operating arm slides (22) pivoted in (21), this was made of $\frac{1}{4}$ in. brass rod (potentiometer spindles) with the ends turned down for pivots, or alternatively it could be fabricated from $\frac{1}{4}$ in. brass rod with pivots made from piano wire soldered into suitable holes drilled in it. The hole drilled radially through it was a size for a good sliding fit on U/C operating arm. 16g. wire arms (23) and (24) were soldered across wire (17) to act as pivots for catches (25) and (26) made from brass strip. *N.B.* (24) had to be slightly higher than (23) so that catch (26) would clear carriage B as it passed underneath. Catches (25) and (26) were tensioned by small 22g. wire springs (27) and (28) ends being bound and soldered to (23) and (24) respectively. Operating arms of 18g. wire (29) and (30) were soldered to the catches (25) and (26) respectively. Wire (29) had an end shaped into an eye. A cord attached to this and fed over three small brass pulleys with aluminium strip retainers, fixed to suitable mountings was fed out to the third line (strong carpet thread), wire (30) end was bent upwards and formed into a ring at the end to make a striking head for the trailing whisker. The trailing whisker (31) was made from 18g. wire soldered to a brass tube suitably pivoted on a former in the fuselage. It had a piece of tinplate soldered on the end to strike on the ground and a circular piece of tinplate soldered to it which struck the striking head on catch (26). The whisker was stopped by a V-shaped notch (32) made from $\frac{1}{16}$ in. ply fitted to a former. The whisker had sufficient spring and weight to knock catch (26) off, but not to hold against it as this catch locked the U/C down for landing. In order to even out the tension from the rubber band (40) actuating the whisker, a suitably shaped ramp made out of three pieces of tinplate, two off (33), one off (34) and a wire hook (35) was firmly soldered to the brass tubing pivot of whisker (31). Thus when the whisker was fully drawn back and the rubber band (40) fully stretched the leverage was a minimum and when the whisker was in its forward position and the rubber band least stretched, leverage was a maximum. As shown in the drawing the mechanism is cocked ready for retraction. Cocking is done in one action by pulling forward carriage A until it locks under catch (25), tensioning both sets of bands (38) and (39). On take off, when whisker (31) swings forward and releases catch (26) carriage B sweeps along wires (19) pulled by band (38) until its travel is limited by stops (36), fuse wire bound and soldered to wires (19). On release of catch (25) for landing, carriage A moves along wires (17) pulled by band (39) taking carriage B with it and lowering the U/C and locking it down as catch (26) engages on carriage B. Carriage A is limited in its travel by stops (37) on wire (17), fuse wire bound and soldered to wire (17). That's it! Nothing more than a lot of bent wire!



MODELLFLYG NYTT, SWEDEN



Full propeller blank and blank with upper face carved. Below suitable carving knife.

PROP CARVING MADE EASY

Simple-to-follow methods of laying out Rubber model Propellers—without theory.

by L Ranson

To anyone taking an interest in Rubber model flying the setting out and carving of propeller blades can present something of a problem, especially if a blade of a particular pitch is called for. Even the most comprehensive plan can give only the sketchiest information on the means of producing a good, serviceable propeller. And, although, by the application of a little common sense, the builder can cope quite adequately with all other aspects of the construction, he is often unable to produce a pair of propeller blades of a quality equal to the excellence of the rest of the model. This is unfortunate, since the propeller is perhaps the most important feature of Rubber design, and certainly it is the prop/power combination that makes or mars the success of a model.

The type of propeller in current use today is the folding blade propeller, and it is the production of blades for such propellers that we shall be dealing with in this article, although the methods shown can be readily adapted to non-folding, free wheeling propellers.

Blades can either be carved from solid block balsa or thick sheet balsa. The former method is the most straightforward, requiring only a correctly dimensioned blank to give a blade of accurate pitch and a properly graduated twist.

The sheet produced blade, on the other hand, calls for rather more ingenuity in obtaining an accurately formed blade. Carving from $\frac{1}{2}$ in. sheet is, of course, cheaper than production from a fully dimensioned blank, but mostly the expert prefers to incur the extra cost which, at a few shillings per propeller, is none too formidable.

Let us take first the block produced blade. Referring to Table A, a series of Diameter and Pitch values are given over the normal range of propellers for medium size contest Rubber models. The pitch is determined by the relation of the block width to thickness at the point of greatest cross section. Thus for a medium pitch propeller (24 in.) of 21 in. diameter, we find in the table that the dimensions for the blank are: 10 in. in length, 2 in. in width, and $1\frac{1}{8}$ in. in depth. These Width/Depth dimensions are marked off $6\frac{1}{2}$ in. from the propeller hub. Dimensions at the tip are 2 in. in width and $\frac{3}{4}$ in. in depth. In applying these dimensions to the Block Blank diagram it will be seen that from the point of greatest cross section the blank tapers towards the hub, and is also tapered, on the upper surface only, towards the tip. Thus the blade angles near the hub are highly pitched, and those near the tip low pitched to give the characteristic twist to the blade.

It will be noted that, whereas the diameter of our sample block was given as $10\frac{1}{2}$ in., the actual block length is given as 10 in. only. This is simply because, on folding propellers, the first half inch or so is removed from the hub end to give clearance to the propeller shaft. Usually prop blades swivel on wire arms projecting approximately 1 in. from the shaft centre. Nose block dimensions and fuselage cross section will affect the length of the arms, but if the blade is bushed 1 in. from the true hub centre there should be adequate folding clearance for most model designs.

Referring again to the Block Blank diagrams, it will be seen that various blade shapes can be obtained without altering the basic dimensions. Blade shape affects the way the blade lies along the fuselage, and the most suitable shape can only be found by experience.

The upper face of the block should be carved first, and the tip shaped before tackling the under side. This ensures that the blade contours, along the diagonals, are more easily followed. Some modellers prefer to have plenty of tip area, and if the tips are left square—just slightly rounded at the corners—quite a pleasing looking and efficient blade results.

The production of blades from sheet is slightly more complicated—the price paid for the greater economy in wood wastage. The blade must be "profiled" out of the narrow block, and the hub angle cut in by means of a template. Medium soft $\frac{1}{2}$ in. sheet is the usual choice, although for a fully proportioned blade it has been found necessary to add a part lamination of $\frac{1}{8}$ in. or $\frac{1}{4}$ in. sheet according to the size and pitch of the blade required. The position and extent of such a lamination is clearly shown in the Sheet Blank diagrams. Generally a $\frac{1}{8}$ in. capping is suitable for the smaller diameter propellers, and $\frac{1}{4}$ in. for the larger diameters.

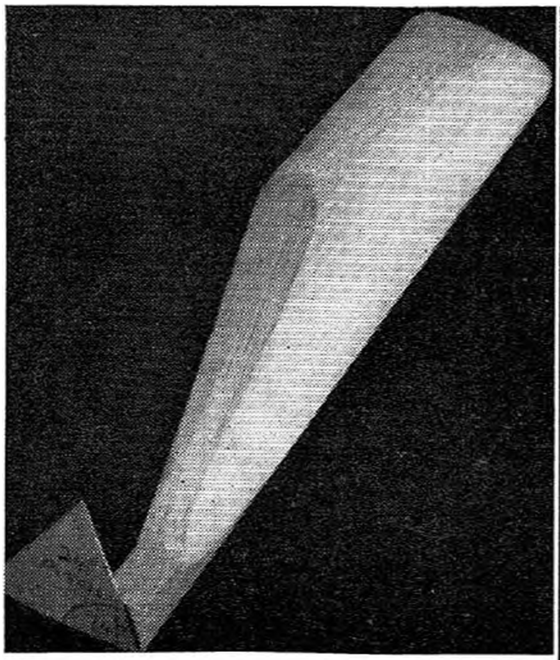
The dimensions for sheet blank blades are given in Table B. The table also gives a series of pitch templates for use in cutting in the requisite angle at the hub. It will also be seen from the table that the angle difference between that at the greatest cross section and that at the tip is fairly constant for all propellers. Any difference to this set angle is too slight to affect the efficiency of the propeller to any marked extent.

Referring again to the hub angle templates, the angle increases, that is, becomes less acute, as the pitch decreases. Thus a 20 in. pitch will require a shallower cut than a 32 in. pitch. The templates shown will only give the correct pitch if the blade proportions given in the table are strictly adhered to. However, if an increase in blade width is required the angle will decrease, that is, becomes more acute, by one degree per $\frac{1}{4}$ in. width added. How this might work out we can see by referring our 21 in. diameter × 24 in. pitch propeller to the table. The blank width is 2 in., the blade length 10 in. ($\frac{1}{2}$ in. allowed for hub clearance), and the distance from the true hub to the greatest cross section is $6\frac{1}{2}$ in. The hub template has an angle of 74°. Now, if we increase the width of the blank by $\frac{1}{2}$ in. we must decrease the template angle to 72°. It is unlikely that a greater blade width than 3 in. on a 21 in. propeller would be called for.

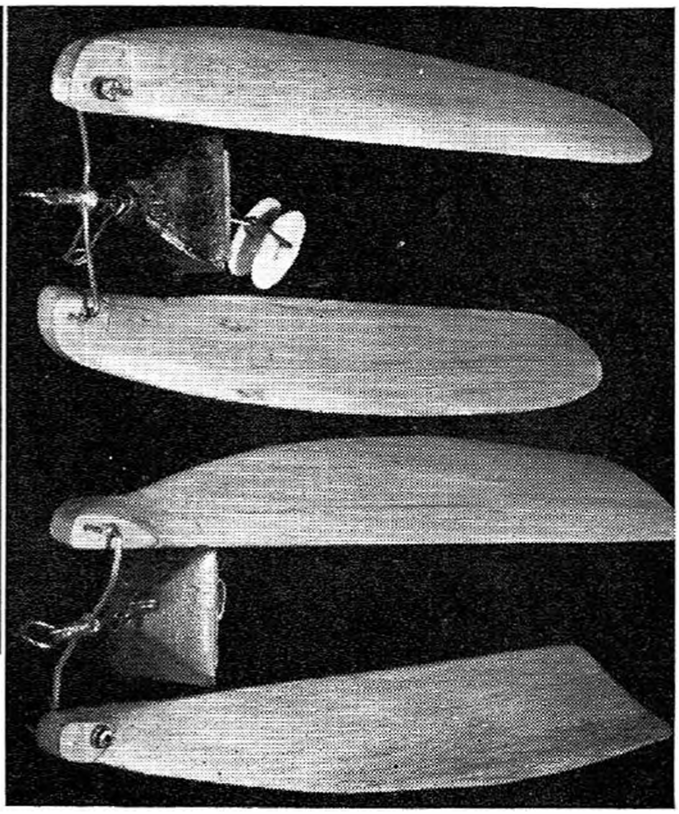
Folding blades can be made very thin and light, and the time spent in sanding to a clean, smooth finish is well rewarded in the efficient looking blade that results. A knife suitable to the job in hand makes for easier carving—safer on vulnerable fingers and equally vulnerable propeller edges. One with a curved blade—such as a fisherman's knife—is useful for carving in the undercamber and in working around the hub, *etc.*, where a straight edged blade would dig in at the wrong places. A few sandpapering blocks of various shapes are a useful addition to your equipment—particularly an arched one for working along the undercamber.

Generous facings of $\frac{1}{32}$ or $\frac{1}{16}$ plywood are essential for a sound anchorage for the brass bush. Drill the hole for the latter slightly undersize and open up with an awl to get a good compression fit for the bush.

The methods shown may not give quite the same high degree of theoretical perfection that the expert might demand, but, nevertheless, the blades produced should give excellent results, either for flying-for-fun or contest work.



Above: Sheet blank. Template ready for cutting hub setting. Right: Two sets of completed blades. Upper are from sheet, lower from block.



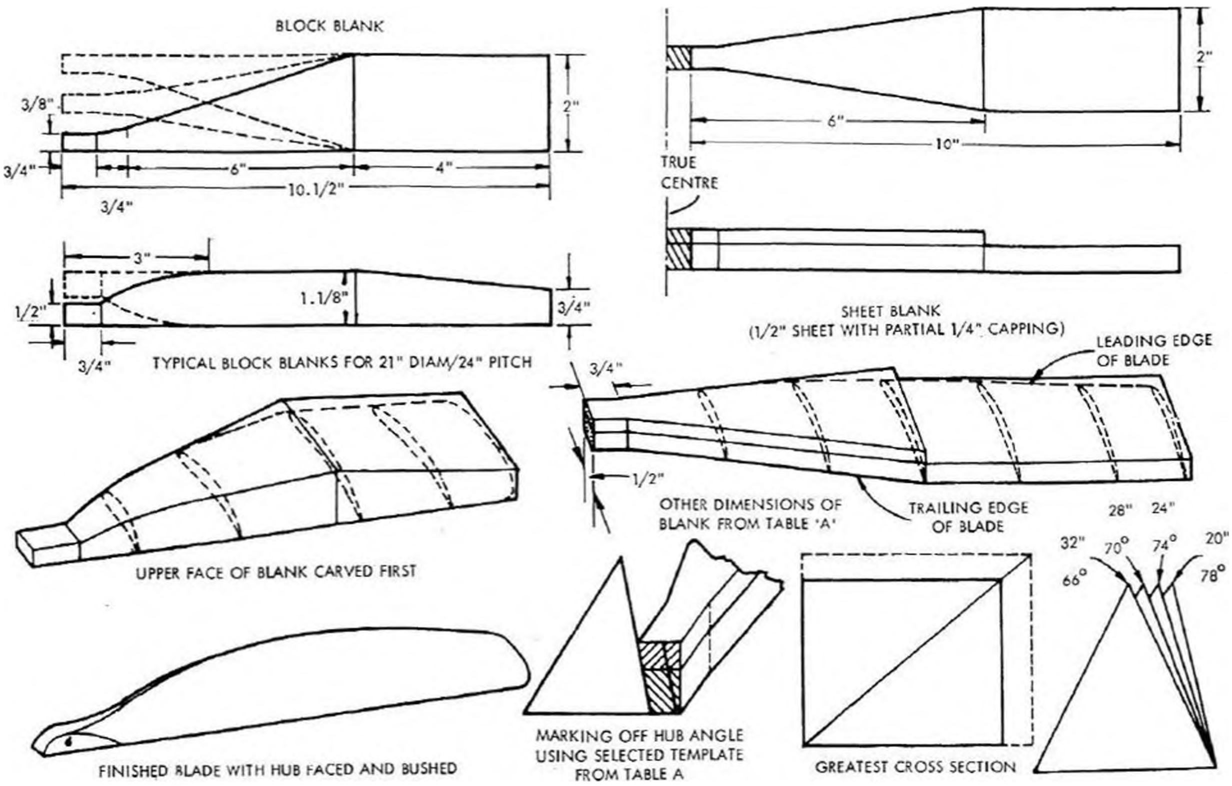
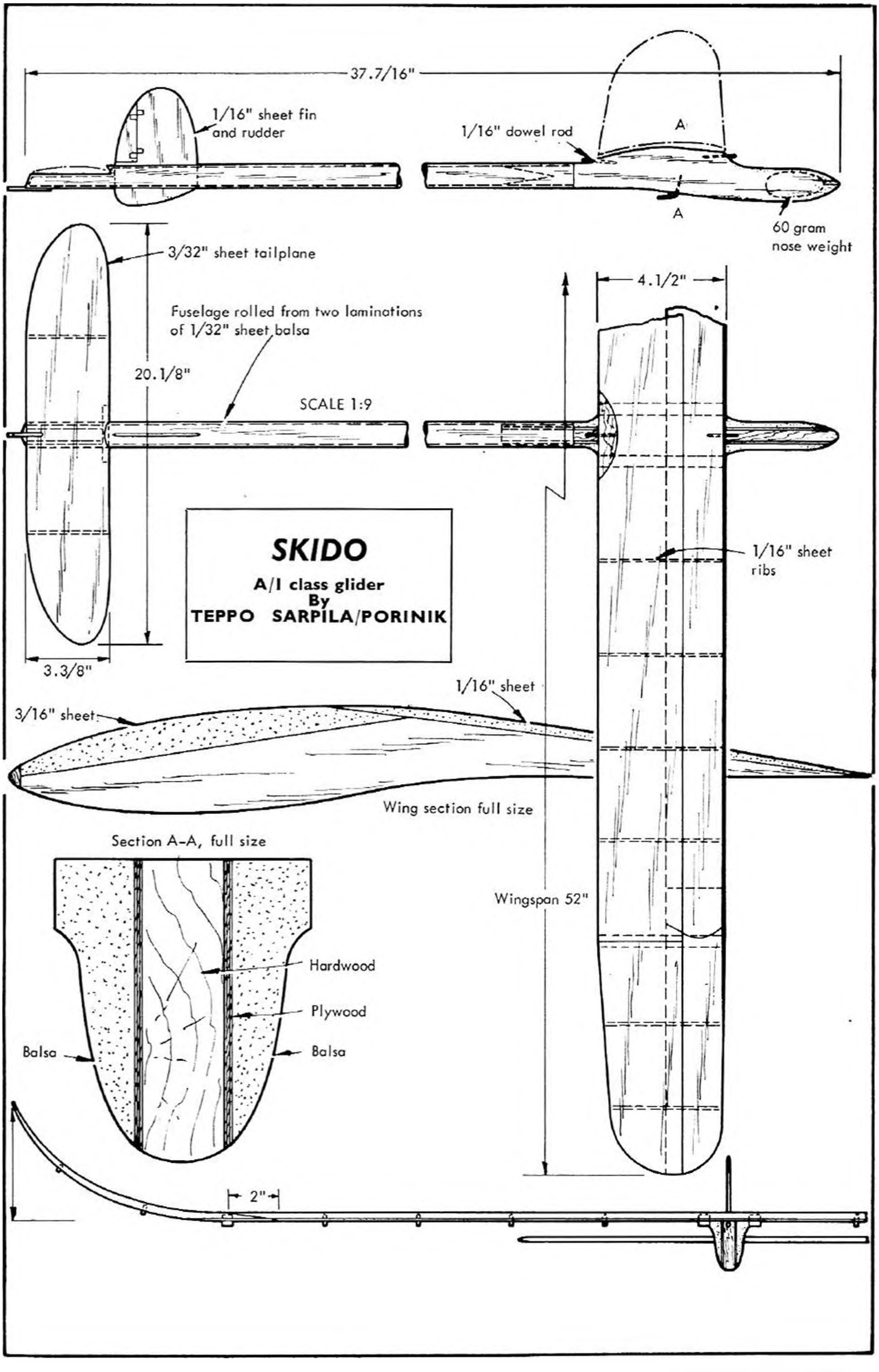


TABLE "A"
DIMENSION TABLE FOR BLOCK BLANKS (IN INCHES)

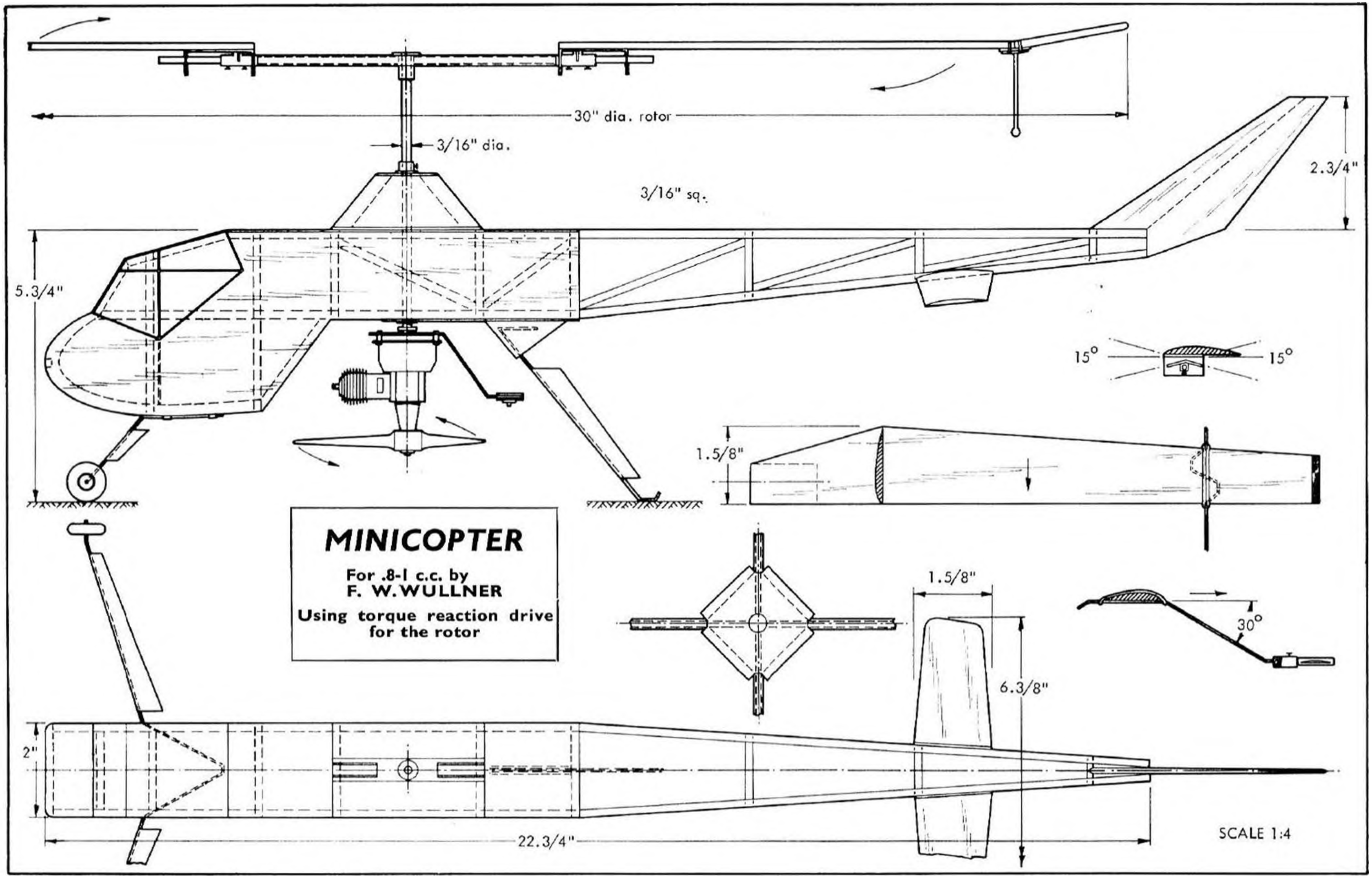
DIAMETER	LENGTH	WIDTH	DISTANCE HUB TO GREATEST CROSS SECTION	THICKNESS AT GREATEST CROSS SECTION AND AT TIP FOR GIVEN PITCH			
				20	24	28	30
16	7½	1½	4⅝				
17	8	1 9/16	5				
18	8½	1 11/16	5⅜				
19	9	1¾	5¾	⅞ / ⅝	1⅛ / ¾	1⅜ / ⅞	1⅝ / 1
20	9½	1⅞	6⅛				
21	10	2	6½				
22	10½	2 1/16	6⅞				

TABLE "B"
SHEET BLANKS DIMENSIONS (IN INCHES)

DIAMETER	16	17	18	19	20	21	22
BLADE LENGTH ...	7½	8	8½	9	9½	10	10½
BLANK WIDTH ...	1½	1 9/16	1 11/16	1¾	1⅞	2	2 1/16
DISTANCE HUB TO GREATEST CROSS SECTION ...	4⅝	5	5⅜	5¾	6⅛	6½	6⅞



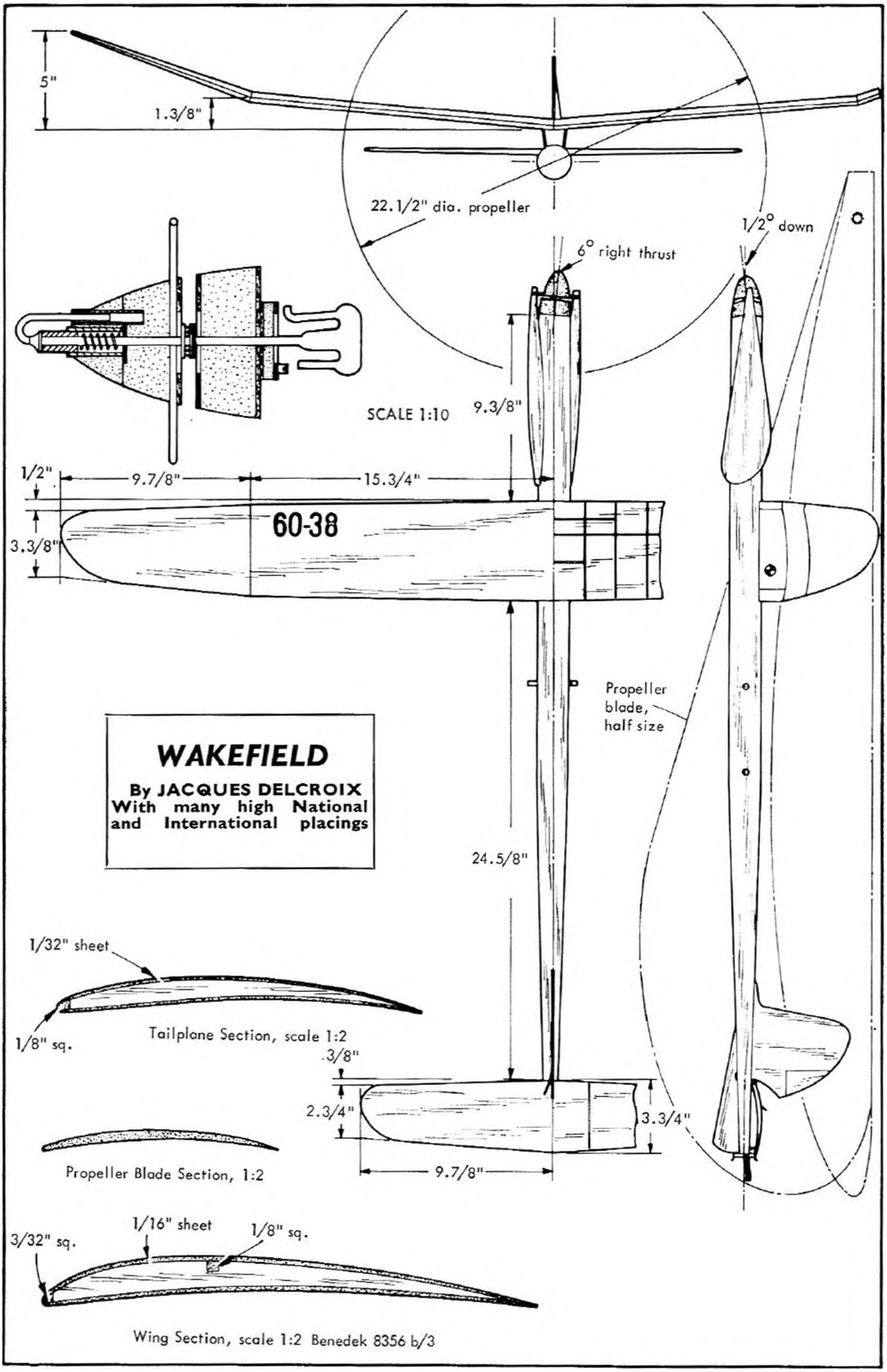
"ILMAILU"—FINLAND

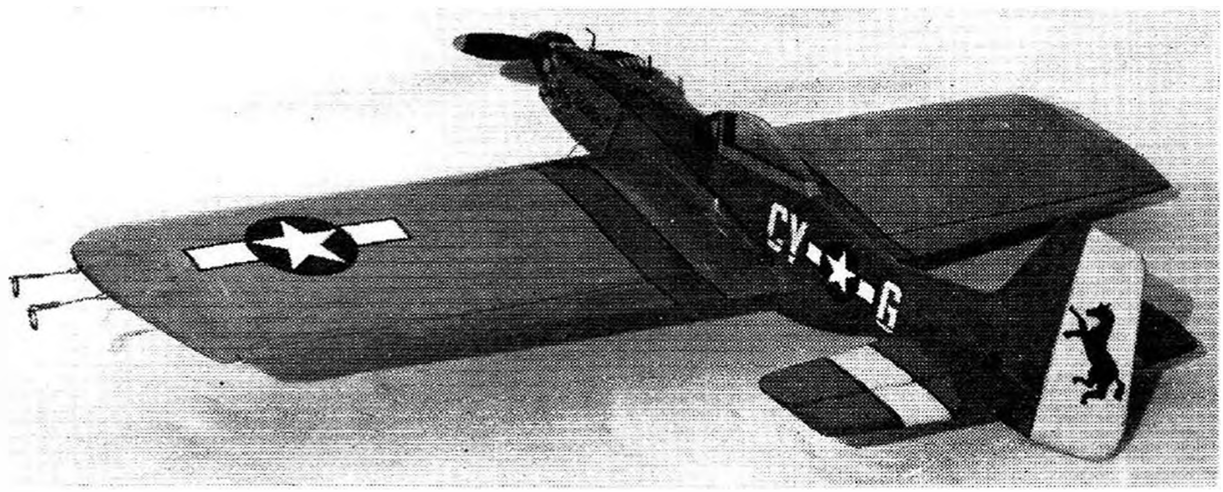


MINICOPTER

For .8-1 c.c. by
F. W. WULLNER
Using torque reaction drive
for the rotor

FLUG & MODELTECHNIK, GERMANY


5"
1.3/8"
22.1/2" dia. propeller
6° right thrust
1/2° down
SCALE 1:10
9.3/8"
1/2"
9.7/8"
15.3/4"
3.3/8"
60-38
Propeller blade, half size
WAKEFIELD
By JACQUES DELCROIX
With many high National and International placings
24.5/8"
1/32" sheet
1/8" sq.
Tailplane Section, scale 1:2
.3/8"
2.3/4"
3.3/4"
9.7/8"
Propeller Blade Section, 1:2
3/32" sq.
1/16" sheet
1/8" sq.
Wing Section, scale 1:2 Benedek 8356 b/3



COLOUR SCHEMES FOR THE UNSKILLED

by R. C. Osborne

MANY people are deterred from embarking on elaborate colour schemes for their models because they have no confidence in their ability to produce a finished article that matches their ambitions. This method overcomes one of the major problems of the unskilled painter. Instead of hand painting or masking of parts where two colours join, one colour is painted on the model and the other on to the sticky side of ordinary gummed paper. When the paint is dry the gummed paper is cut to the shape required and then soaked off in water like a transfer and stuck along the dividing line. The balance of the area to be painted is then completed in the normal way without having to come to the edge at all with the paint brush.

This operation may take just a little longer than its description but it really is simple, in fact using cellulose dopes in normal room temperature the transfer should dry in between fifteen and twenty minutes; soaking off takes under a minute.

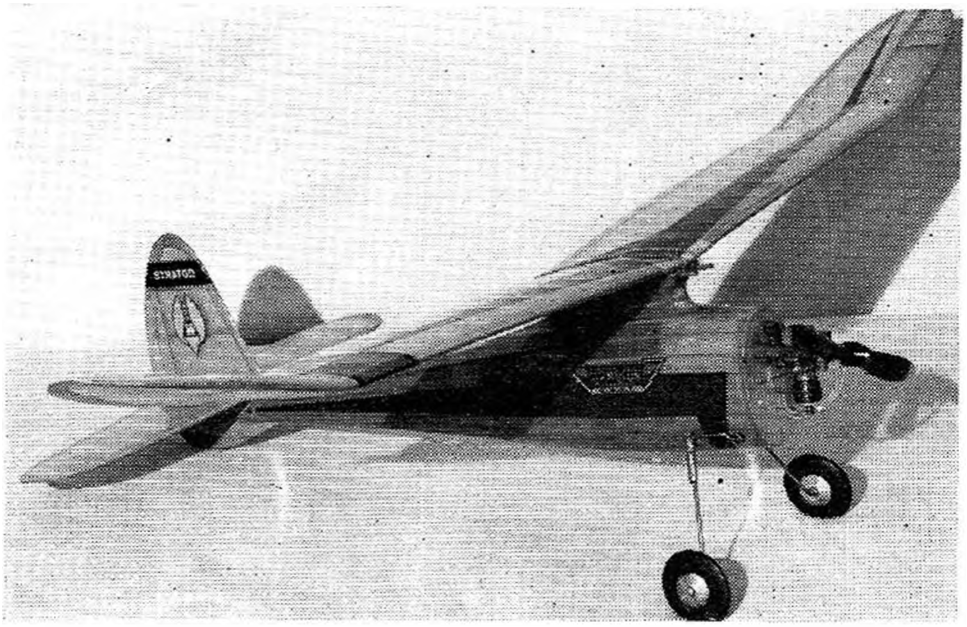
Anyone who has tried in vain to obtain a decent finish by conventional techniques may like to try this foolproof method. It is clearly much simpler to get a smooth curve or straight line on a piece of paper than paint one on the surface of a model. The method of operation that follows shows how this basic truth is worked out.

The method has been used mainly with cellulose dopes on model aircraft but is equally practical for enamels which differ only in drying time and so could well be used for decoration on plastics and indeed on any kind of model, enamel paints do take rather longer to dry, of course.

Additional equipment required other than paint, brush, and model, is the gummed paper. Any type will do but the thin gummed paper labels, sometimes described in the stationers as Economy Labels, are ideal. About 1,000 such labels can be bought for 5/- or thereabouts. Big sheets of paper or rolls are not recommended; strips of wet paint longer than 6 in. can be tricky to handle.

Method of working should follow this general pattern. First decide upon the colour scheme, bearing in mind that curves are just as easy as straight lines and angles, so there is no need to be anything but fairly ambitious. It may pay to look through any available books or magazines to gain an inspiration. Once a scheme has been seen that appeals one can figure out how to apply it.

Mark the various colour divisions on the model with a soft blunt-pointed pencil to avoid scratching the surface. Do this as accurately as possible using a

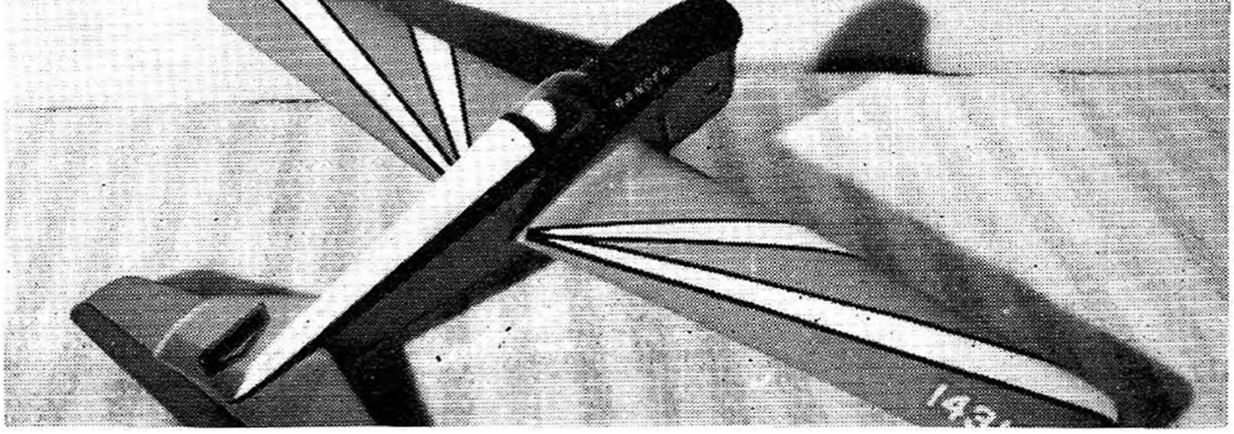


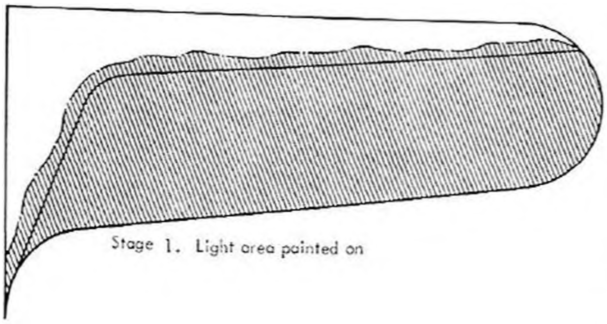
ruler and French curves for the rounded parts. If you do not possess any French curves then you must extemporise with such things as biscuit tins, saucers, tea cups, to get the shapes you require. It is surprising how many useful shapes and sizes will be found in the larder and china cabinet.

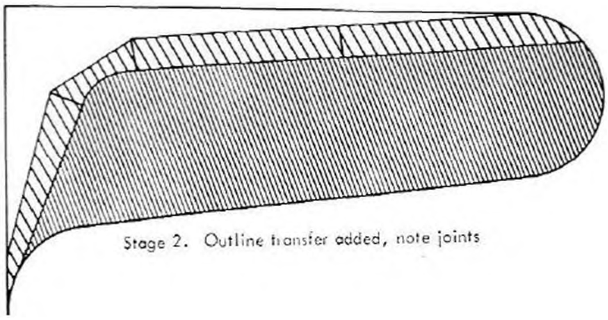
Paint in the areas of lighter colour slightly overlapping the pencil outlines which should continue to show faintly through, even after several coats. If, for any reason, it is necessary to start with a dark colour such as navy blue or black, the colour division will have to be marked again using a light coloured pencil.

Now to make the transfers, paint should be as thin as will allow a reasonably dense colour with one coat. But rather than a gooey thick paint use two coats. Paint an adequate amount of paper and allow to dry. The slower drying enamel can be force dried if the corners are pinned down to prevent heat curling it. It is not necessary to heat dry dope since it dries so quickly anyway.

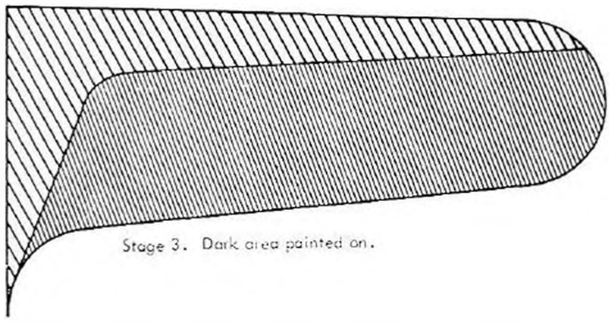
Using the same teaplate template or whatever you had for the outline of the model, cut out the outline transfers with a pointed razor blade. Curves or lines that are longer than the 6 in. labels are made by butt jointing or overlapping several strips. If possible the butt joint method is better but if the colour is smooth and thin a little overlapping will not matter.







Place the transfers to soak in warm water and as soon as they loosen pull them off with tweezers (do not slide) and place them on the model pressing down well with blotting paper. It is advisable to wet the area on to which they are being placed because they can then be manoeuvred a little into position.

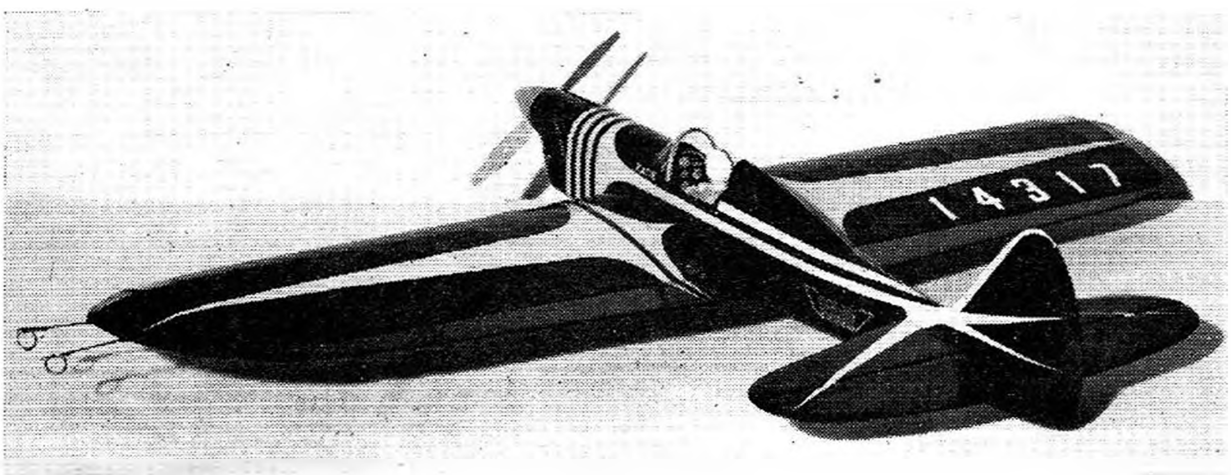


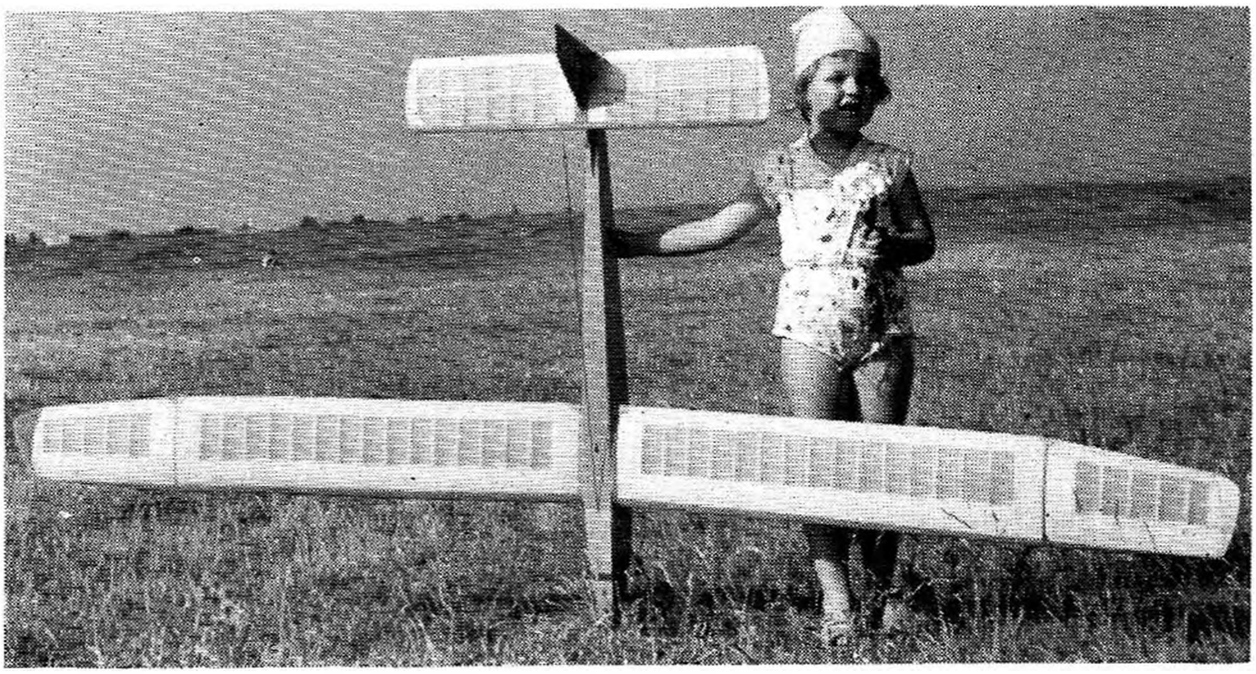
When the transfer has set and it is clear that they are firmly in place the balance of the area can be painted in and the job is complete.

When using cellulose dope it is necessary for the whole operation to be carried out speedily. If transfers are allowed too long to dry or soak they tend to harden or crack. As soon as dope, therefore, is dry enough it is ready to use. If there is a slight ridge discernable after painting up to the transfer this can be removed by brushing thinners along the ridge. A better result is obtained with enamels, however, if they are sanded down.

This basic method can be elaborated to produce quite complicated schemes, for example, coating several rectangles of different sizes produces a rectangle with borders if stuck together or triangles of reducing sizes can be adapted to make a neat personal motif with initials in the centre. Chequer-board patterns and similar designs can be evolved. Other uses of the scheme is to repair paint flaws or scratches. For some reason paint applied by this transfer method seems to have a better continuity of colour than a normal painted coat.

The models illustrated in this article have all been decorated by the method described and the author would not dream of using any other method.





A NEW R/C COMPETITION

Franz Czerny of Austria suggests a new approach to single channel sports flying.

FLYING Radio Control models is, for many modellers, almost their only possible means of flying at all (apart from control line). Only a small flying area is needed. The pleasure of actually controlling a model in the air is most rewarding but it is essential to have equipment which is both inexpensive and foolproof. High cost of equipment could mean the death of radio control flying if depth of pocket is the criterion for success. What is needed is a form of flying to appeal to a very wide selection of enthusiasts to introduce new faces on the flying field and to avoid complicated manoeuvres which demand expert qualities in the operator.

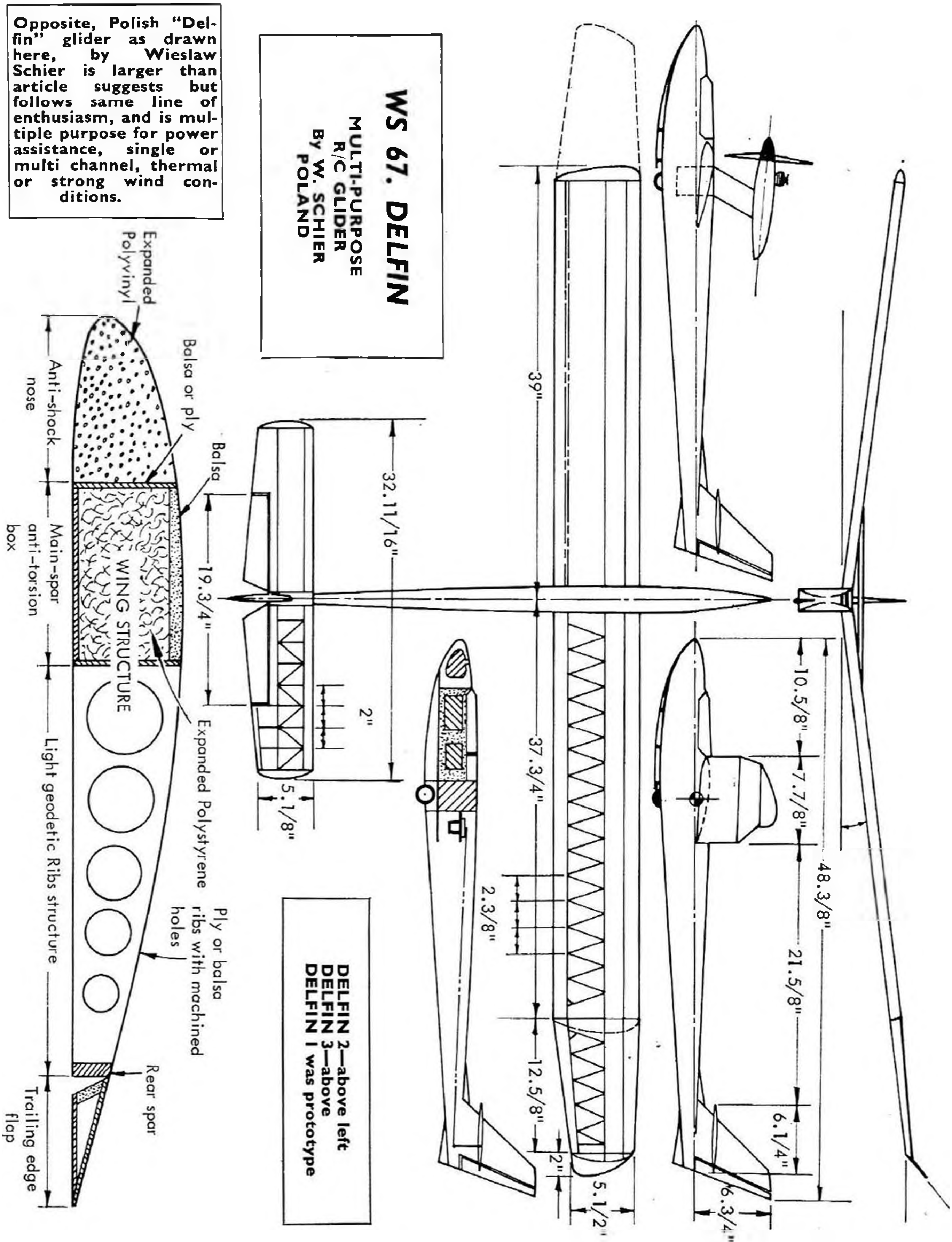
A new kind of competition is desirable meeting the following conditions:

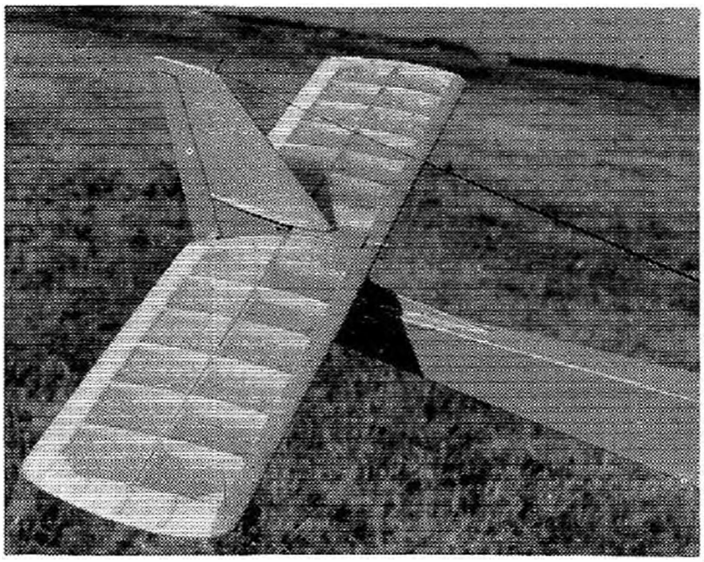
(1) To be of continuing interest to a large number of aeromodellers;
(2) To require inexpensive models and equipment;
(3) To place an emphasis on aerodynamic and tactical problems of controlled flight;
(4) To be interesting as a method of model flying even without the stimulus of competition.

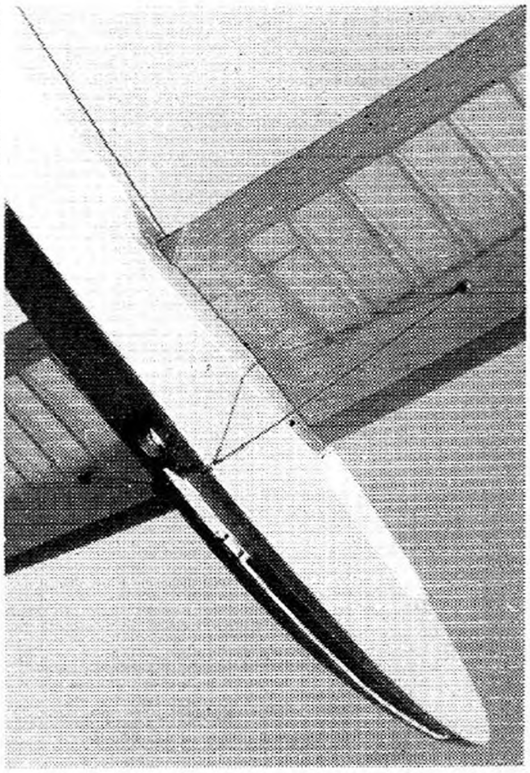
To consider these points in more detail, for a competition to remain interesting everyone must have a reasonable chance of winning. If the same people continually win, then interest wanes—some degree of luck as well as skill must be introduced. We would mention the so-called "thermal lottery" as an example!

The Nordic (A/2 sailplane) shows that the simpler kind of competition model attracts the most followers, especially where all models are of approximately equal performance and in the end luck plays its part in finding the winner.

Opposite, Polish "Delfin" glider as drawn here, by Wieslaw Schier is larger than article suggests but follows same line of enthusiasm, and is multiple purpose for power assistance, single or multi channel, thermal or strong wind conditions.







Above, tail units of Delfin drawn on previous page, this one does not have the in-set elevators. At right, the braced wings and small wheel for landing. Ballast can be carried in fuselage for extra rough conditions. Fuselage is a ply and balsa box, sharp nose enables it to penetrate soft earth on dive landing or deflect on a slope.

Under point 3 we want models to *fly*. In control line flying, for example, it is basically a model *engine* sport, the model itself being only really a means of demonstrating the engine. What we need is a competition for the model aerodynamicist rather than the model engine technician.

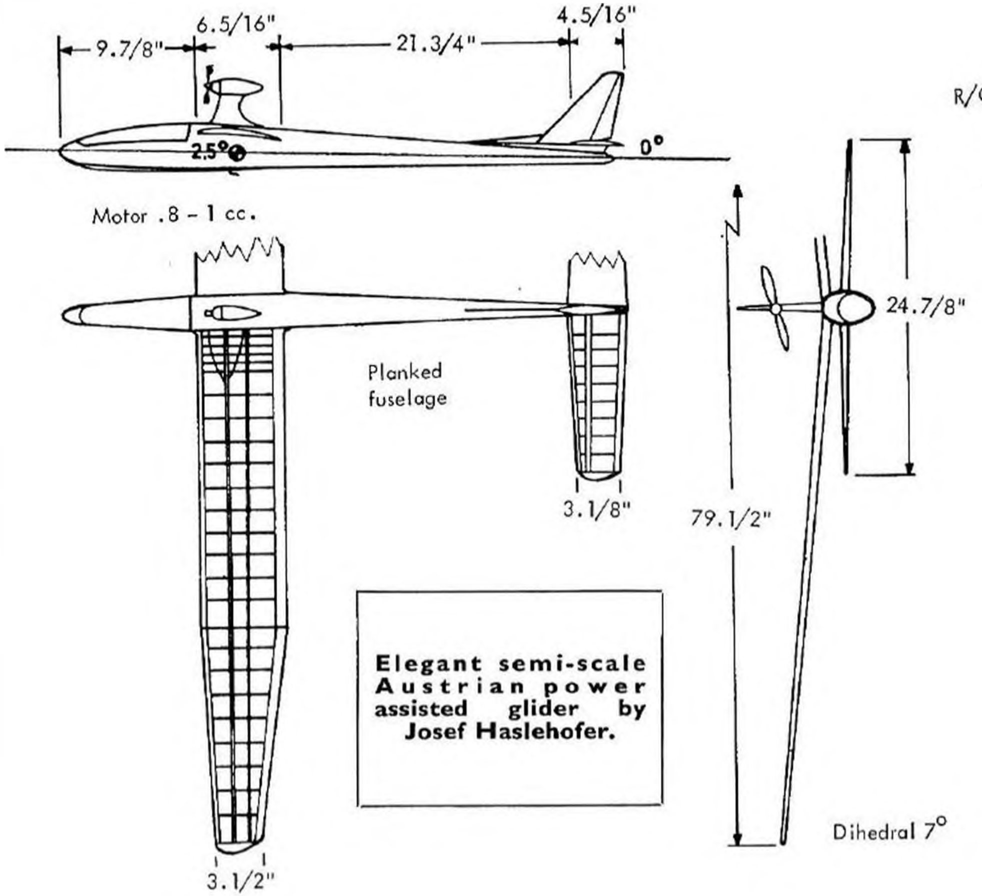
We must devise our competition so that even the simplest gear enjoys the same opportunities of winning as more costly equipment. Therefore, if we can introduce thermal flying (soaring) we have equal opportunity for simple single channel gear as well as more expensive and complicated multi gear.

Maintaining interest in flying is important. The kind of flying enjoyed by the sports flyer would not appeal to the speed enthusiast. We must find a broader base of interest to attract many people.

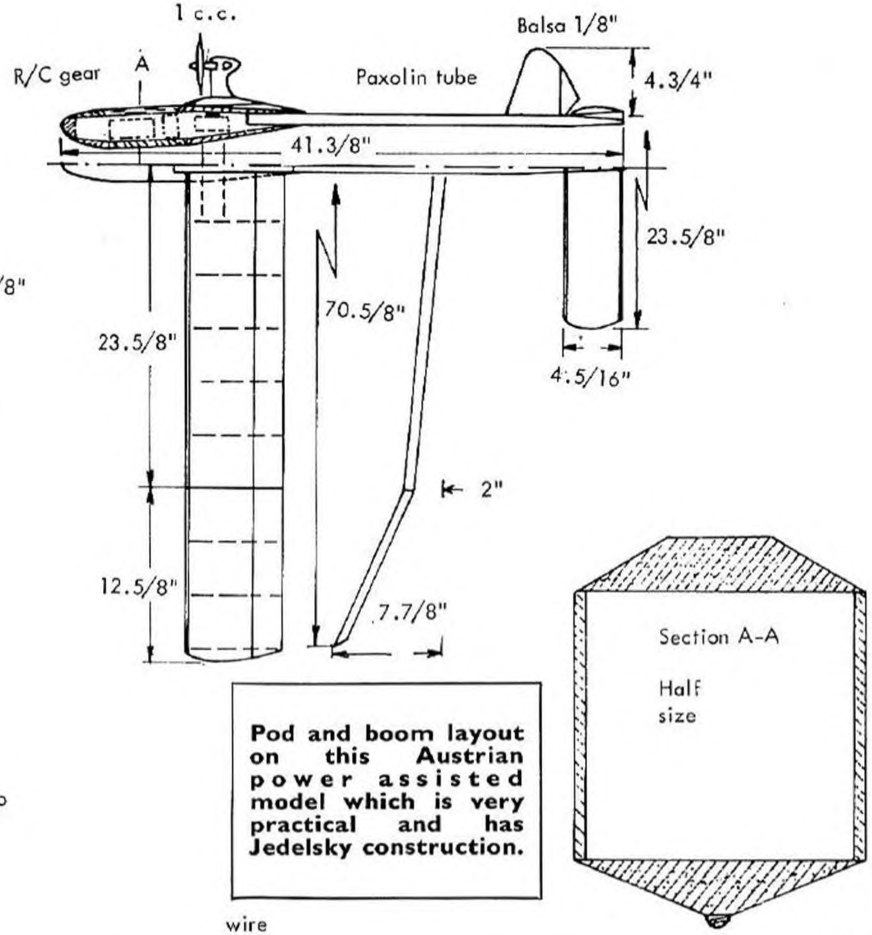
Consideration of these points has produced a proposed radio control motorised glider as the flying unit. It should have a maximum wing span between six and seven feet—a top weight of about $2\frac{1}{4}$ lb., an engine capacity not exceeding 1 c.c. The optimum time per round of 300 seconds would earn 300 points, each second and over or under this time would involve deduction of 1 point. Landing should take place within seven minutes and in a circle of 300 ft. diameter, otherwise flight would be invalid. Each 18 in. from the centre point would involve 1 point deduction. The scoring would be based on the total of three rounds which would give a maximum possible of 900 points.

We suggest motorised gliders because using today's materials it is possible to make a stout model of about Nordic size including engine and R/C equipment to come out at under 2 lb. Such a model can be of good aerodynamic design and capable of soaring flight, its sinking speed should be $1\frac{1}{2}$ to 2 ft. per second and soaring should be practical in the 100 to 300 ft. height where thermals often have a vertical velocity of 2 to 3 ft. per second.

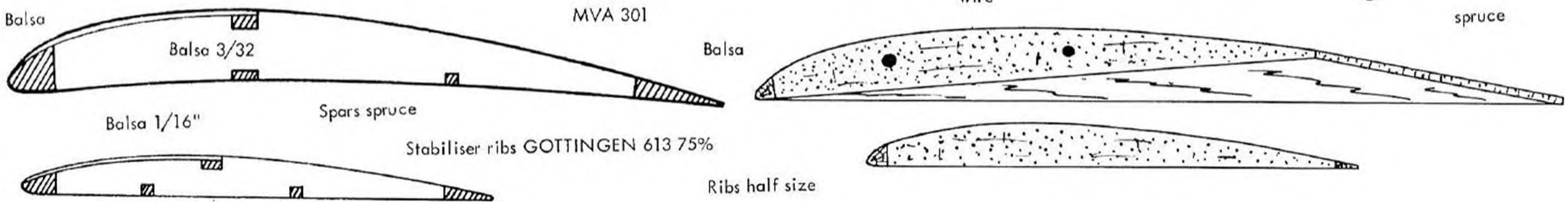
Since the model has radio control it should not be blown away too much but can be brought back over the field to circle right up to the extreme height of



Elegant semi-scale Austrian power assisted glider by Josef Haslehofer.



Pod and boom layout on this Austrian power assisted model which is very practical and has Jedelsky construction.



visibility. Anyone with experience of the problems of tow-line starting using a 300 ft. line will gladly accept the benefits of the motor assisted glider.

No large flying field or helpers are necessary, it should even be possible to allow a wider selection of engines than envisaged above if larger capacity ones are given shorter running time though the ideal is 1 c.c. as a maximum since models would climb at slow speed and not become lethal weapons. If engine run is limited then soaring flight will be essential to obtain 300 seconds.

In order to keep the running time of any contest within reason a strictly limited time for starting flight and landing must be set with penalties of disqualification. Again, to keep events simple, precise stop watch and tape measure flight checking should be necessary only for more advanced events.

Another point in favour of the powered glider is the possibility of soaring flight without needing hill slopes to achieve it.

This type of model has been flown under contest conditions such as we have set out since 1957 when an inaugural meeting was flown in the neighbourhood of Vienna.

The initial entry mustered fifteen contestants and the event was staged over two days with three rounds to be flown. Winds gusted sometimes up to 60 ft. per second and normal ones were up to 40 ft. per second, low cloud and rain made conditions even more testing. In spite of this only one model was a "write-off" through "pilot error", one other flew out of range. In these three rounds no models achieved the theoretical maximum as soaring was not possible but gentle climbs for three minutes and straight glides into wind for another three minutes were readily achieved as well as landings in the 300 ft. diameter circle. Two minutes were allowed for starting of motors and three minutes engine run. Engines were located in the usual pylon position over the C.G. This still seems the best and simplest solution.

Two sizes of models proved their worth of 6 ft. span and 8 ft. span. The larger flies more gracefully but is more vulnerable—the other is faster and skilfully designed with better penetration.

A further try-out for this scheme of R/C motorised gliders took place at the long established event for magnet steered models and this was the first time that R/C motorised gliders were flown in the Alps at an elevation of some 6,000 feet. Here again they proved their worth. It was a pleasure to watch them soar in conditions which would not have otherwise been possible. There was plenty of air space so that a pilot error involving loss of height could be recovered in two to three minutes and it was quite easy to fly for long periods, even to record standards.

Finally, the present day possibilities of the R/C powered glider can be gauged by the growing interest of kit manufacturers in providing construction kits for this type of model; and listing of conversion kits for their normal radio control gliders.

There is of course the International and most honourable Challenge Trophy now established for this type of model. It is the *Alex J. Houlberg* Trophy established by the Association of Belgian Aeromodelling and usually run in conjunction with the Control-Line Criterium each year. The rules restrict engine capacity to 1.5 c.c. maximum and the model must weigh more than 2.2 lbs. per c.c. The model is required to fly from a 100 metre line for not more than four minutes and to make a spot landing by which it is judged for accuracy of control. Motogliders are permitted up to 1 minute engine run. It is hoped that this competition will establish itself as a major event and will gain full International support.

ANTI-WARP STRUCTURES

by Bill Henderson

A chance remark by a club member at a summer flying session made me realise that many modellers are not familiar with some of the more recent trends in structural design. A contest model, more than any other type is required to be a reliable, consistent performer under all weather conditions. One of the factors that can drastically reduce this reliability is a warp, whether weather induced, heat induced, or produced by building faults.

There are three main causes of warps:

(*i*) Built-in stresses in the frame.
(*ii*) Lack of rigidity in the finished frame.
(*iii*) Insufficient strength in the frame to resist the tension and torsion loads created by the doped covering.

The first cause is best seen in the sanded Trailing Edge. In sanding, a considerable proportion of the surface fibres are compressed down into the body of the wood due to the pressure which must be applied. This results in a T.E. that bends upwards towards the surface that has had the most sanding. To avoid this type of warp, both sides of the section must be sanded or preferably the maximum amount of material should be removed by planing (even this causes a little compression) and a minimum removed by sanding. All this work must be done before the T.E. is built into a structure, otherwise the structure will be twisted when sanding is finished. To ensure that the structure comes off the building board flat, all sanded stock that is used must be flat before being cemented into place.

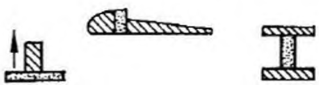
Other examples of built-in stresses are the oversize rib slot and the spar glued in place with a high shrinkage glue giving results as shown: (1)

(1)

(2)

(3)

(4)



and the opposite effect of forcing an oversize spar into a rib slot. (2)

The second and third causes of warps are variations of the same problem, *i.e.*, structural design. The standard single spar system has the merit of being simple and light, but it relies on the tautness of the covering for its strength, and unfortunately covering materials are never stable, being affected by both temperature and humidity. Although this structure can be produced flat in a covered and doped condition, by pinning it down to a building board throughout the drying process, it cannot be guaranteed to remain true. Dope takes at least twenty-four hours to set and can show some tautening for one or two weeks afterwards.

Thus in the single spar system the usual location of the mainspar, as shown below, will allow a spanwise bowing. Twisting can easily occur due to lack of torsional rigidity. (3)

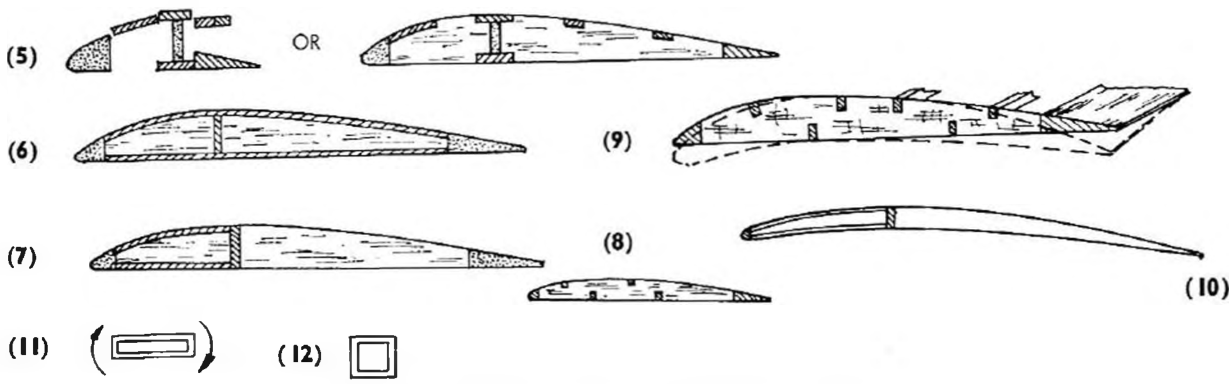
A simple structural analysis shows that, with reference to the spanwise bowing, we actually have a beam of the shape shown (4) by moving all structural elements together in the plane of bending.

This has most of the properties of the tee section which has a tendency to warp in the direction of the upstanding leg: and is also weak in this direction.

The ideal section in bending is that used in the "I" beam:

This is difficult to achieve on models but could be approximated by doing something like: (5)

Ideally the major wood sections should be at the outside surface which leads to: (6)



the all sheeted wing which is both a closed "I" beam and a hollow box, extremely rigid in torsion.

If such a structure would be too heavy then it can be modified to produce the traditional "D" nose which is an "I" beam and torsion box (if completely closed on all faces): (7)

For lightweight structures the all-sheeted wing can be modified by removing, spanwise, sections of sheet to produce the multispar system: (8)

Because there is now no closed box section, this structure is not very rigid in torsion and does suffer from the fact that the small section spars are vulnerable to breaking, due to local impact loads. A multispar, to be successful, must have the spars equally distributed on top and bottom surfaces, otherwise, when covered the side having more spars will have a greater to tightening loads and the structure will warp towards the side with fewer spars, chordwise and spanwise: (9)

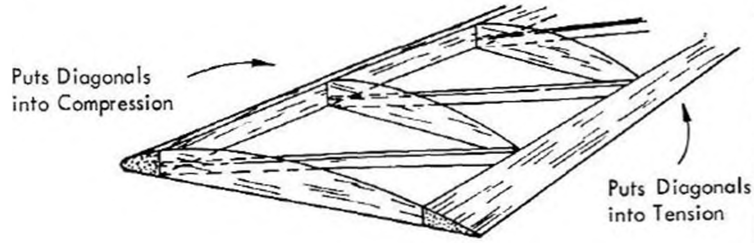
None of these systems is particularly successful when applied to a thin wing section as is used on modern Wakefields and A2's except, perhaps, the all-sheet covering which can produce weight penalties. The reason for its lack of success is due to insufficient rib depth producing a torsion box like this: (10) which can easily be twisted: (11) compared to: (12) which is very rigid in torsion.

Another method of improving torsional rigidity in a conventional structure is by diagonal bracing. Now when the structure is twisted, the diagonal braces will go into tension or compression: (13)

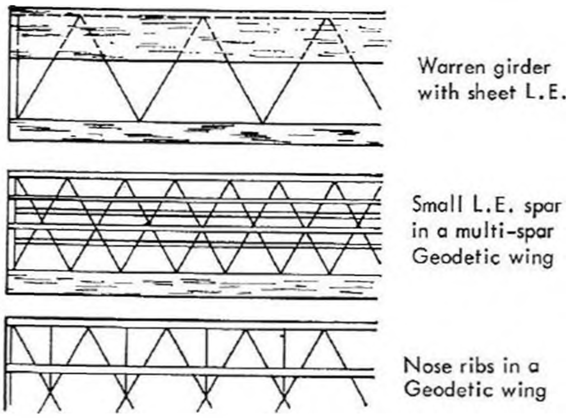
This system is not very satisfactory since the diagonals must be large in sections to resist compression forces, with an obvious weight penalty.

It is more logical to use the ribs themselves as the diagonal braces since there is hardly any weight penalty involved and the spars required for spanwise bending stiffness, stabilise the ribs from buckling under compression loads.

(13)



(14)



This leads to two typical anti-warp structures—Warren girder and Geodetic.

Both types have the problem of distorted nose contours duc to relatively large areas of unsupported tissue in this area, the Warren girder being much worse than Geodetic. This can be overcome by using either a sheeted leading edge, small spars, or nose ribs as shown: (14)

Alternatively in Geodetic construction, the angle between ribs can be reduced especially on wings, where $22\frac{1}{2}^\circ$ to the normal rib position has been established as an optimum. For tailplanes and lightweight wings a 30° angle appears to be the most efficient structurally. (15)

It must be remembered that these structures are very rigid in torsion due to ribs always being in compression: (16)

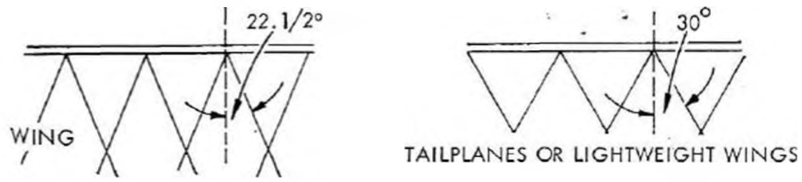
They have little bending resistance by themselves and always require some form of mainspar or multispar to give adequate spanwise stiffness.

To summarise then, all models of the high performance type using thin wings such as Wakefield, A2 glider and many power models should have anti-warp tailplanes and wings with the order of preference of structure being (*i*) Geodetic, (*ii*) Warren girder or multi-spar. For thicker wings a fully closed torsion box such as a D-nose will give a clean wing aerodynamically, and adequate warp resistance.

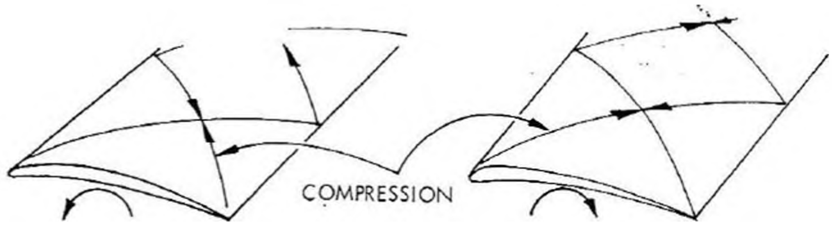
For those who have not constructed a Geodetic wing before, it should be remembered that the wing rib section at an angle requires a simple projection from the normal detail to follow the correct shape of diagonal ribs. This technique is shown in diagram: (17)

Although it looks complicated, it takes no more than an extra fifteen minutes or so to draw up. Remember that this extra time can now save hours of retrimming before and during each contest, since there will be few perceptible variable warps requiring trim corrections. As for the construction aspects of such a wing, two variations are currently used,

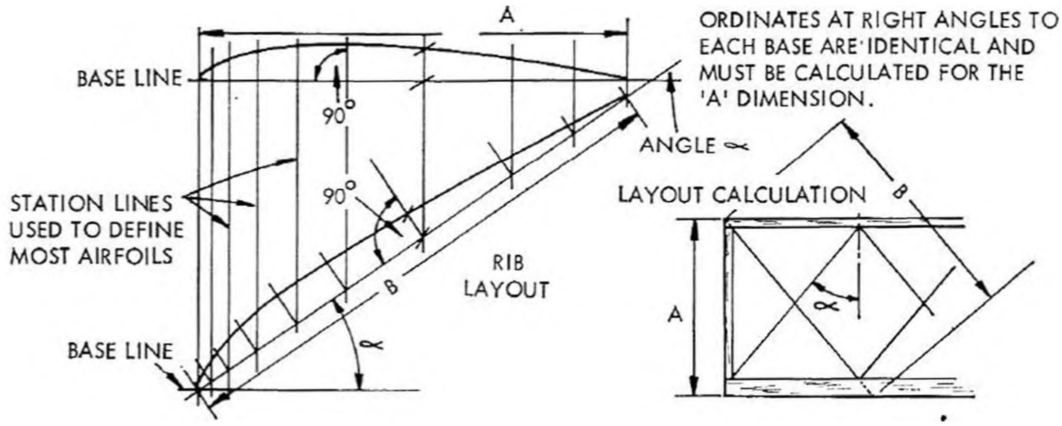
(15)



(16)



(17)



1. Choose one diagonal direction and cement in solid ribs at these locations. In the opposite direction the ribs must be split, chamfered to the correct angle and well cemented in place: (18)
2. For ribs no thicker than $\frac{1}{16}$ in. the ribs can be notched at the meeting point, and well cemented to the next mating rib: (19)

The above techniques are intended for use in Geodetics with one crossing point. Where it is intended to use the "egg-crate" type Geodetic presently seen in Italian contest models, a different construction technique is required. Parallel strips of balsa of the required rib thickness are cut with mating slots producing two typical rib blanks: (20)

These are glued in place between partially sanded leading and trailing edges. Two sanding blocks with the upper and lower wing contours faced with garnet paper are also required. Laying the wing down on a flat surface with the underside up, the lower contour is sanded to shape first: (21)

The wing is then turned over and the top surface sanded to contour: (22)

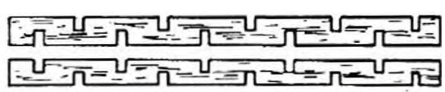
This last operation must be done carefully to avoid distorting the contour by too much sanding pressure. The author has used a similar technique to produce true airfoil contour on a single crossing geodetic in a tapered tailplane and wing. In this instance, similar straight strips of balsa are used at rib stations with either of the two previous joint crossing construction techniques used. A plywood rib is lightly cemented in place at the root and at the top.

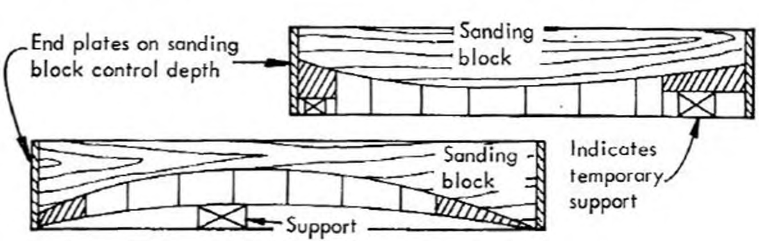
A sanding block long enough to rest on the two plywood template ribs is prepared with coarse sandpaper, then by careful sanding, the contour can be brought down to the level of the plywood ribs. (23)

(18)

(19)

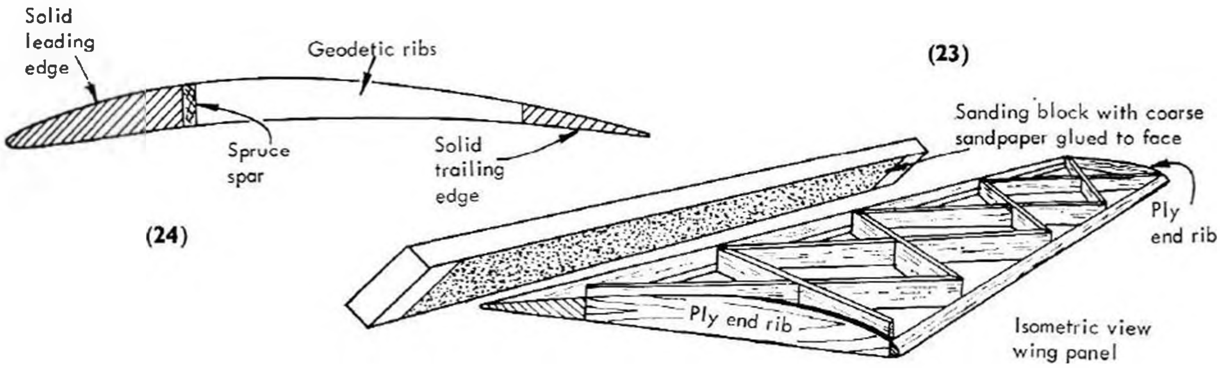
(20)





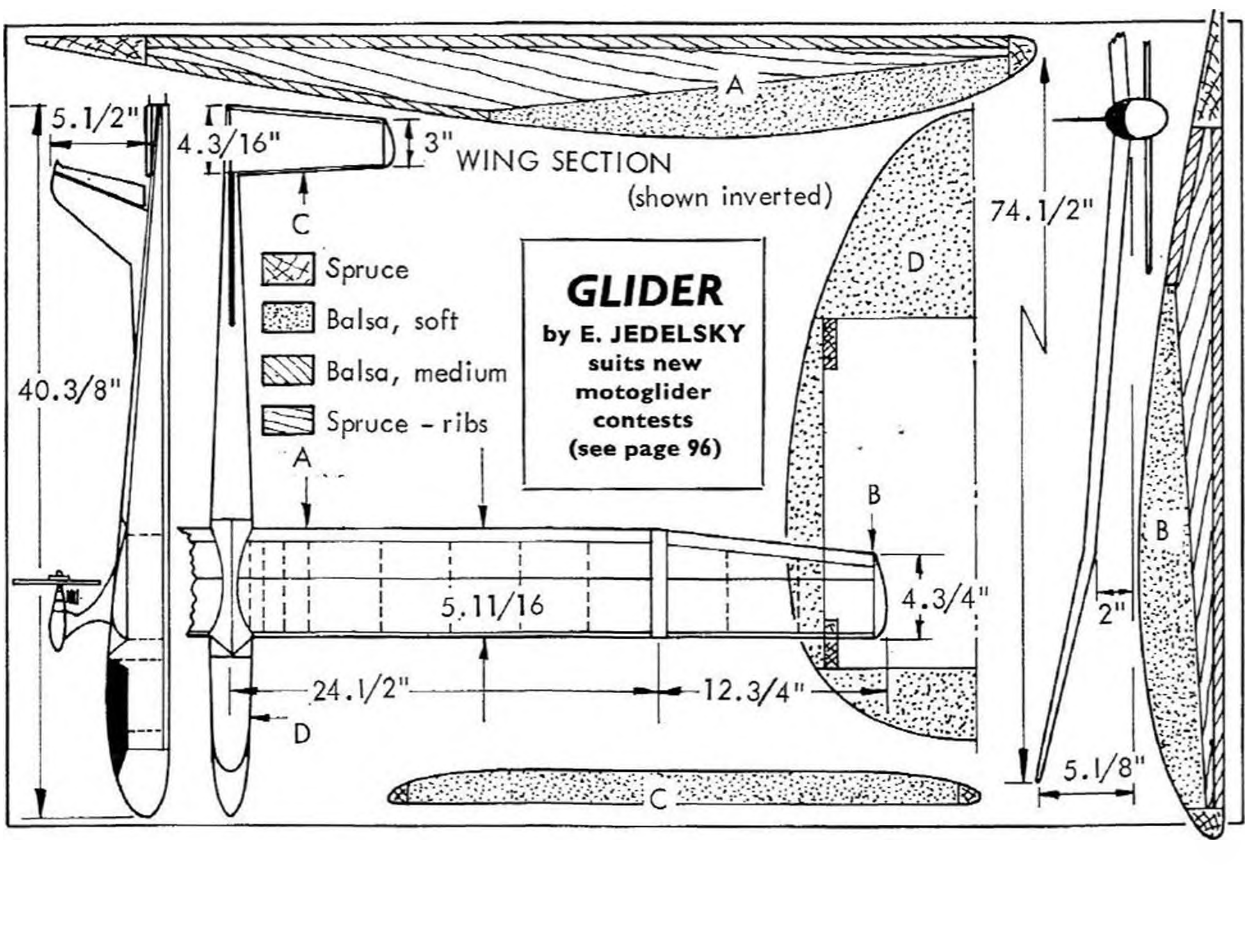
(21)

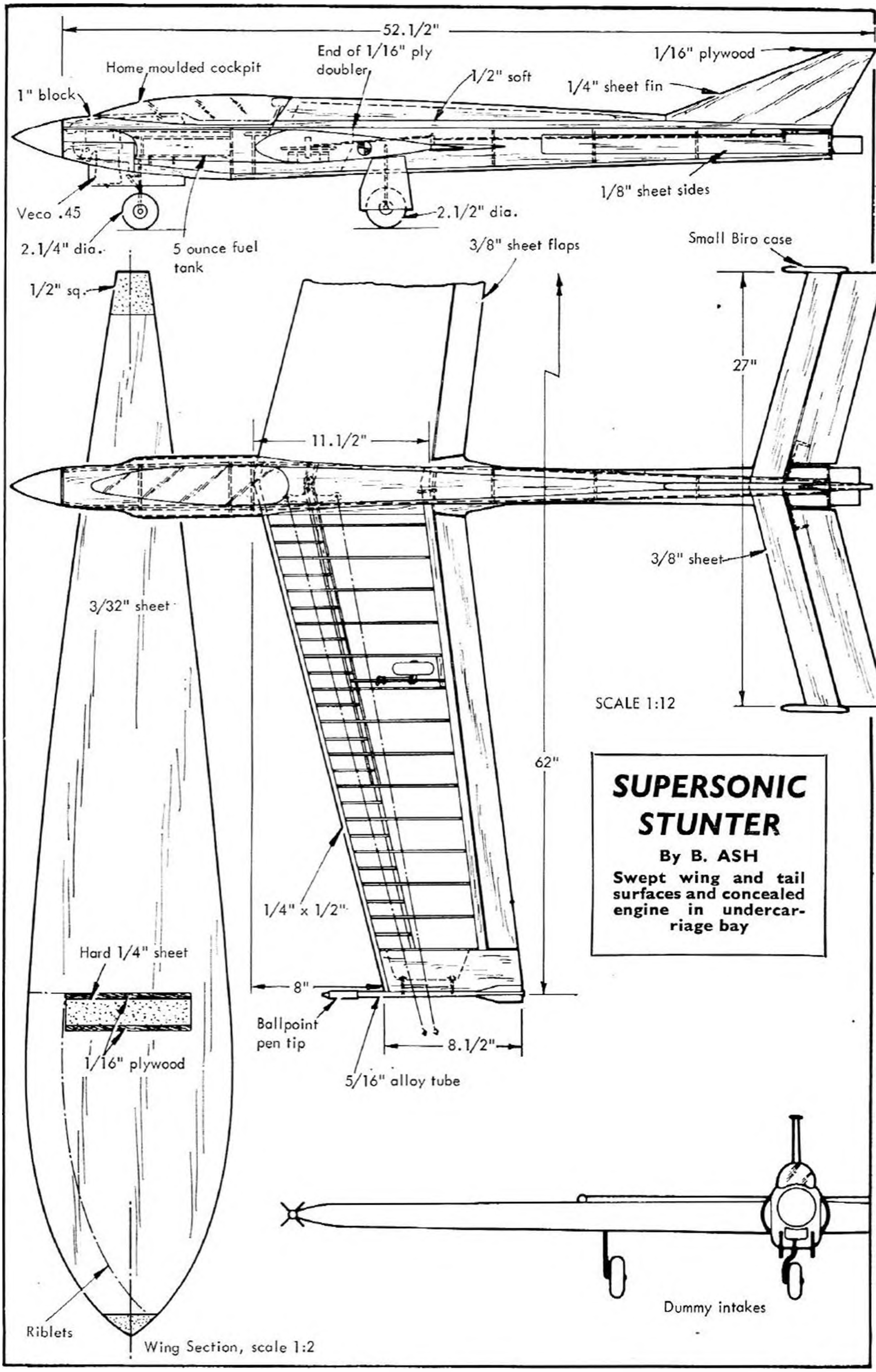
(22)



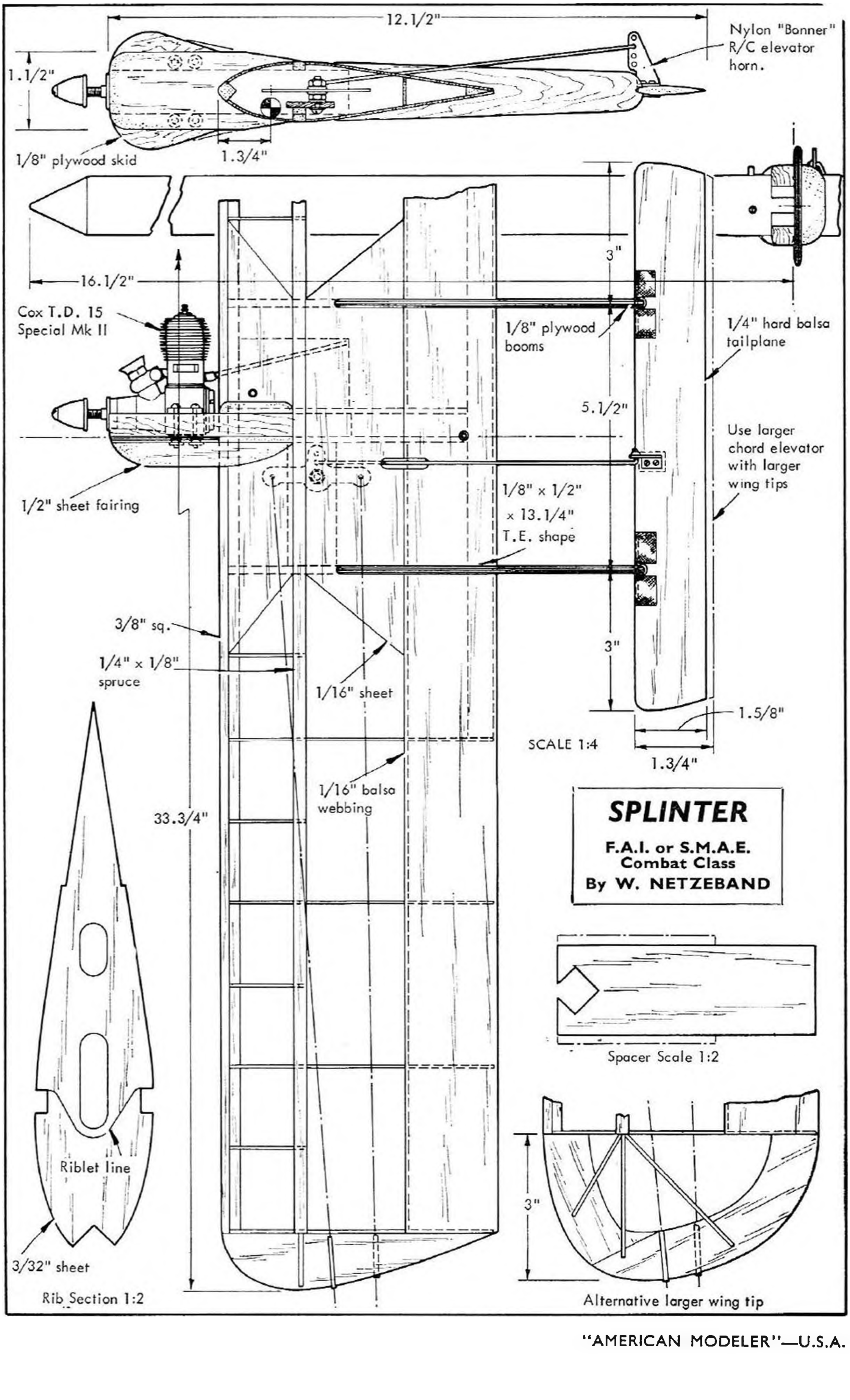
In conclusion, we will describe the construction of the author's latest A/2 wing to show how a correctly contoured nose entry can be combined with a stiff spar and geodetic anti-warp structure. The section is Benedek B 6556b on a 6 inch chord, which gives a maximum thickness of $\frac{3}{8}$ inch. Adequate strength in bending can only be obtained by using a $\frac{3}{8} \times \frac{1}{8}$ spruce spar, since weight is not a problem the nose is solid balsa forward of the spar. The slightly "flapped" trailing edge allows the use of a $1\frac{1}{2} \times \frac{7}{32}$ T.E. section leaving a 3 in. wide area in the centre of the chord for geodetic ribs. When covered with Jap silk the wing is flexible in bending, but rigid in torsion. (24)

I hope this article is of some assistance in your next A/2 glider—or perhaps even a power design.

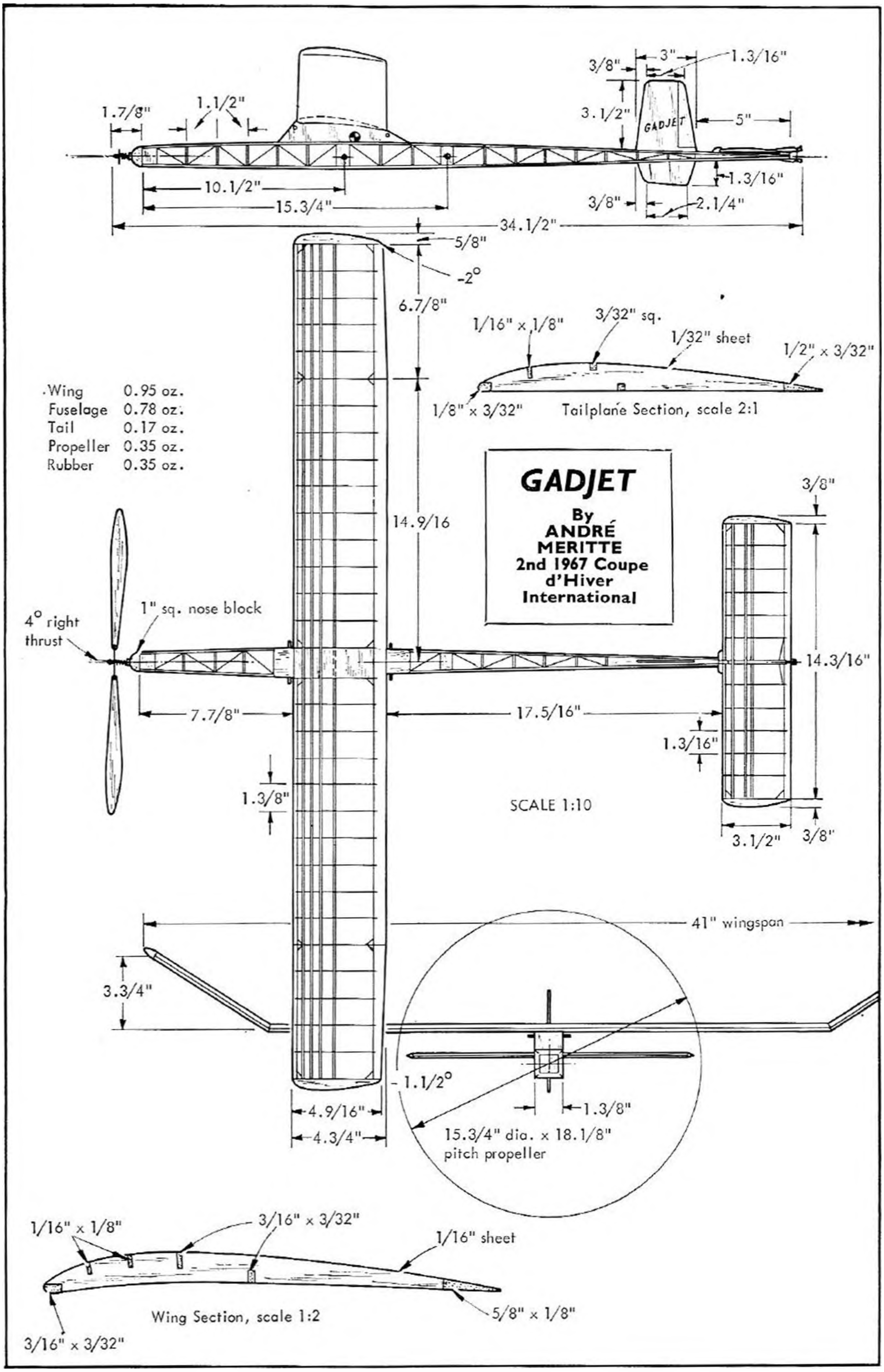


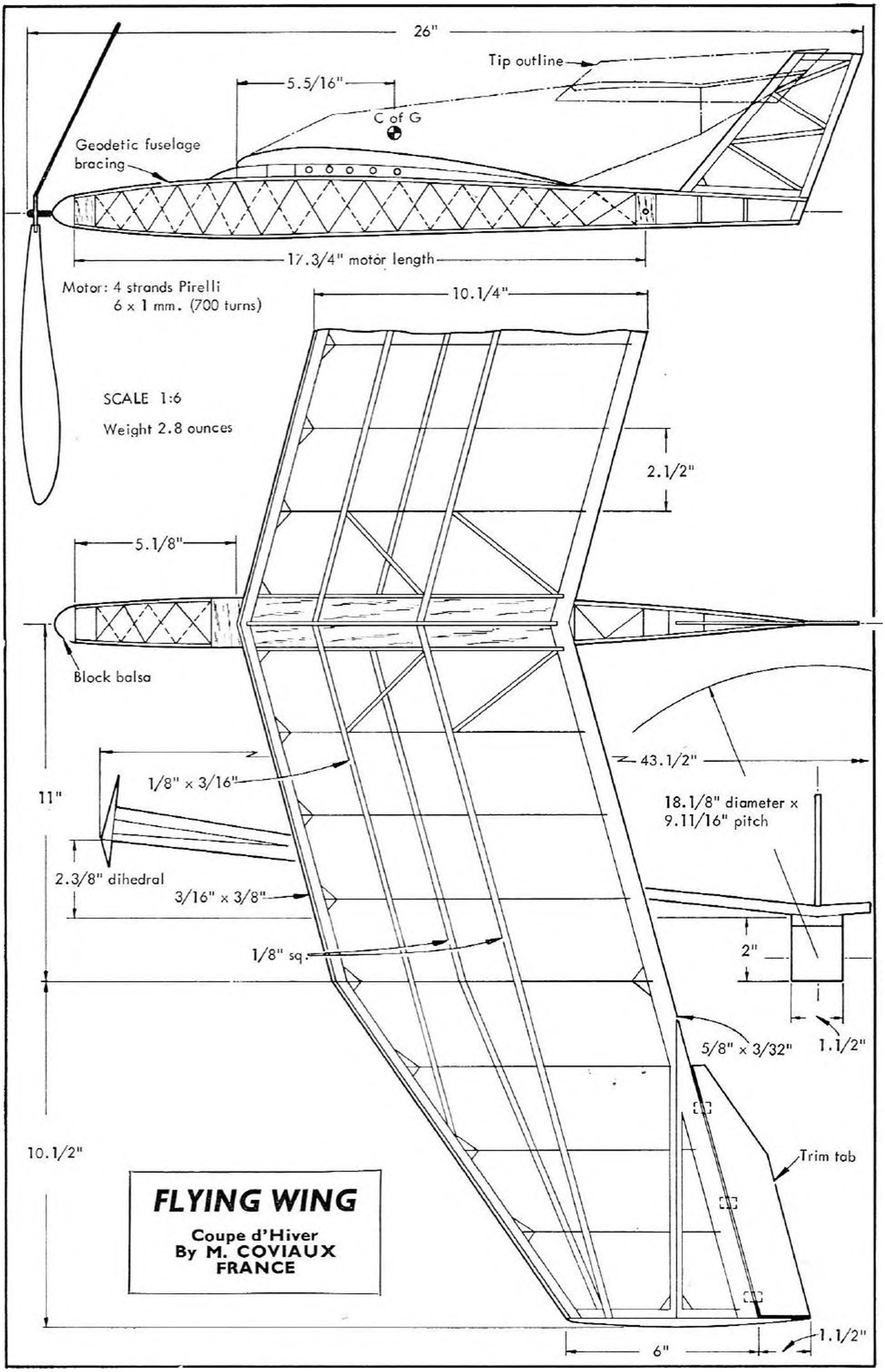


"FLYING MODELS"—U.S.A

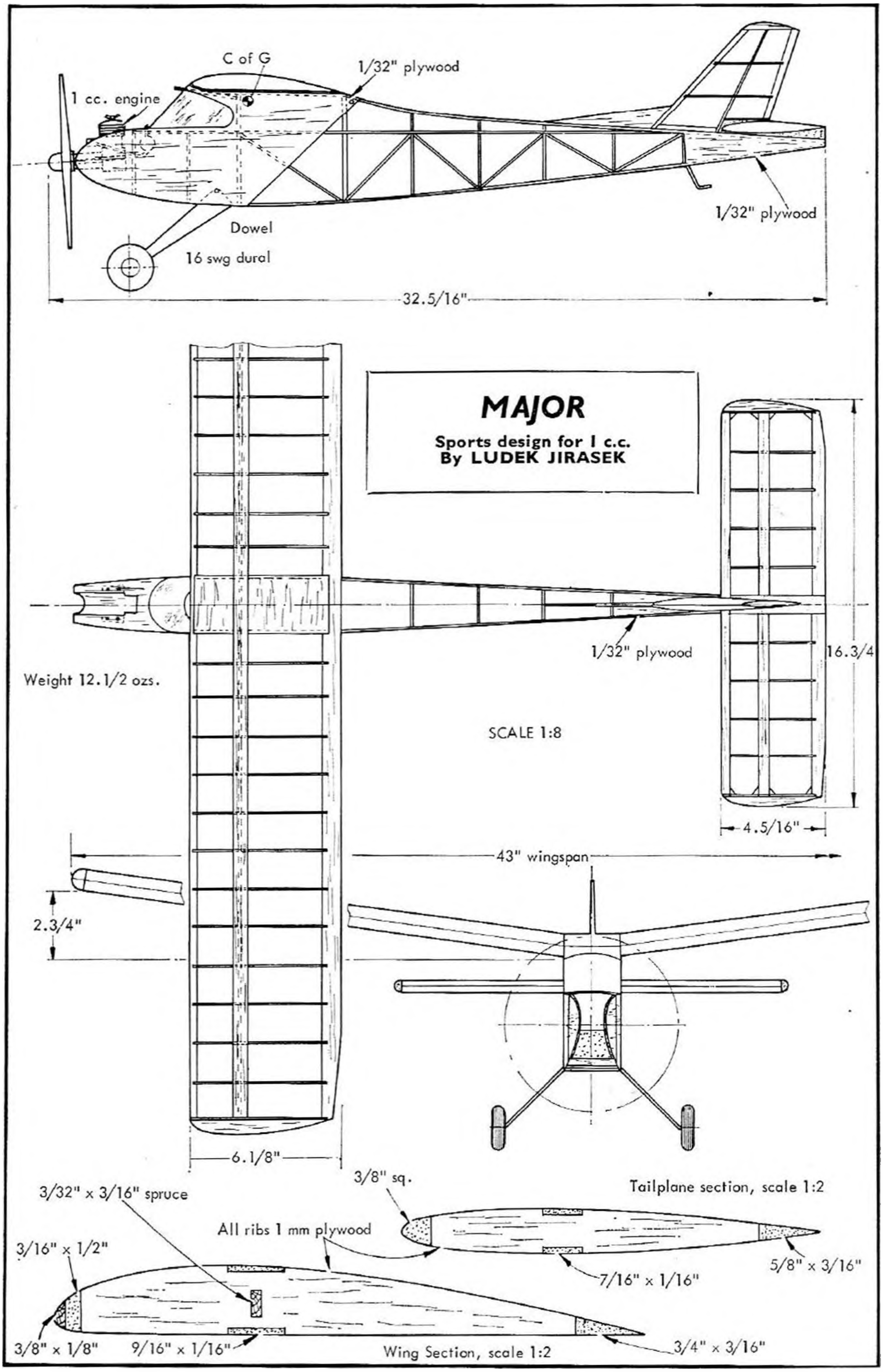


"AMERICAN MODELER"—U.S.A.

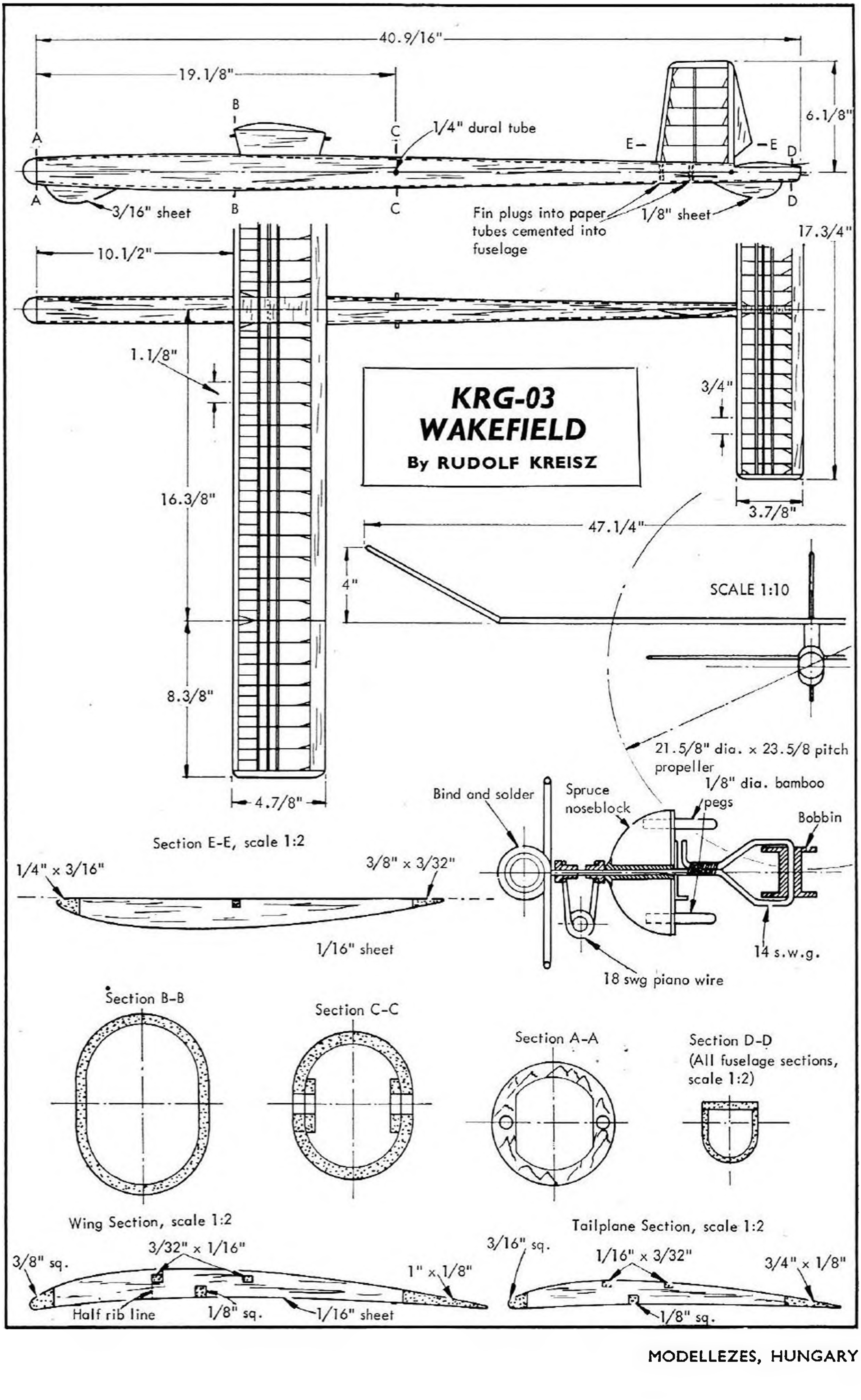

GADJET
By ANDRÉ MERITTE
2nd 1967 Coupe d'Hiver International
Wing 0.95 oz.
Fuselage 0.78 oz.
Tail 0.17 oz.
Propeller 0.35 oz.
Rubber 0.35 oz.
Tailplane Section, scale 2:1
1/16" x 1/8"
3/32" sq.
1/32" sheet
1/2" x 3/32"
1/8" x 3/32"
1" sq. nose block
4° right thrust
SCALE 1:10
41" wingspan
15.3/4" dia. x 18.1/8" pitch propeller
Wing Section, scale 1:2
3/16" x 3/32"
1/16" sheet
5/8" x 1/8"
34.1/2"
10.1/2"
15.3/4"
1.7/8"
1.1/2"
3/8"
3"
1.3/16"
3.1/2"
5"
2.1/4"
5/8"
-2°
6.7/8"
14.9/16
7.7/8"
17.5/16"
1.3/8"
14.3/16"
3.3/4"
- 1.1/2°
4.9/16"
4.3/4"



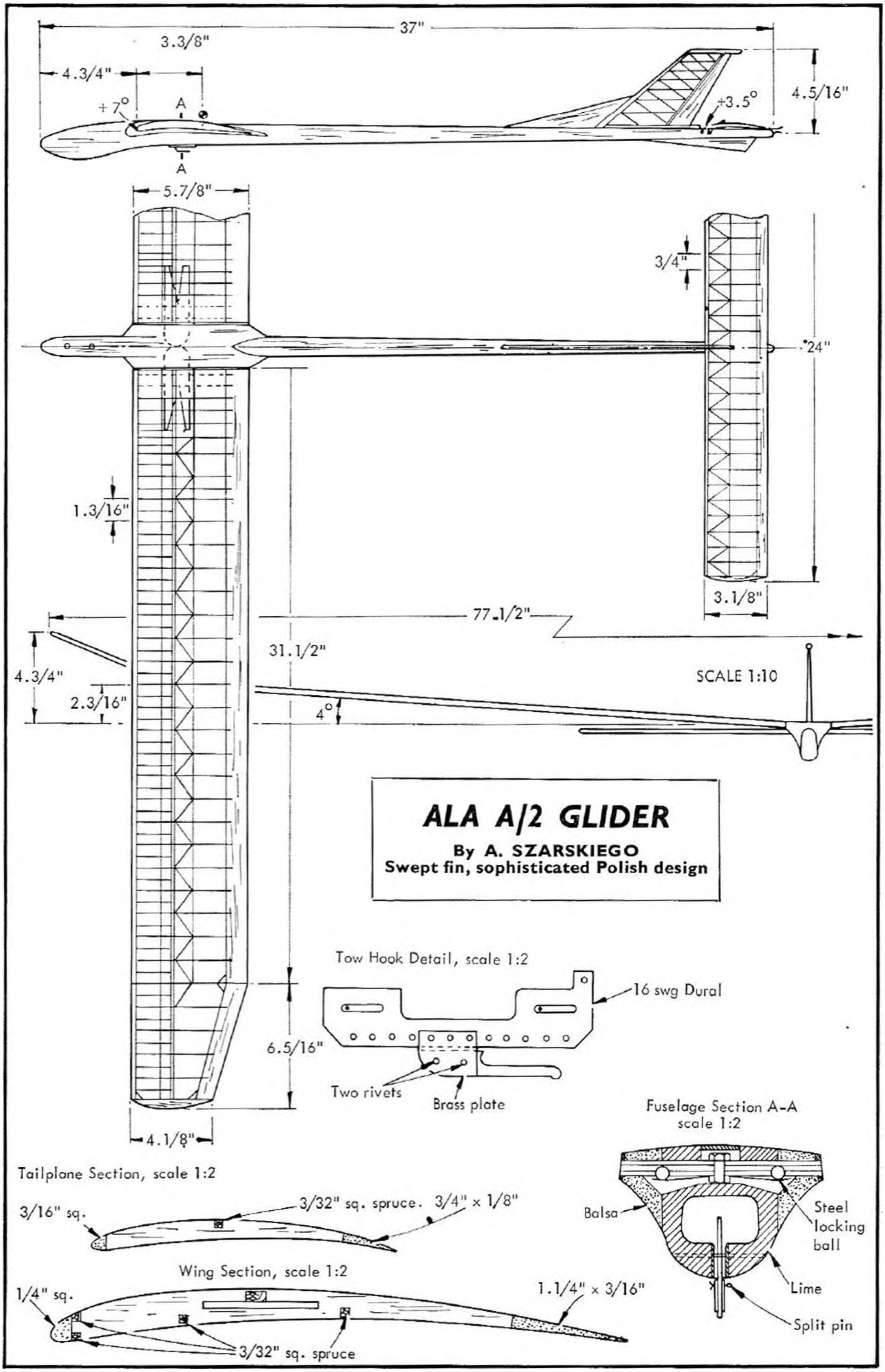
VIA MODELLISTICA, ITALY



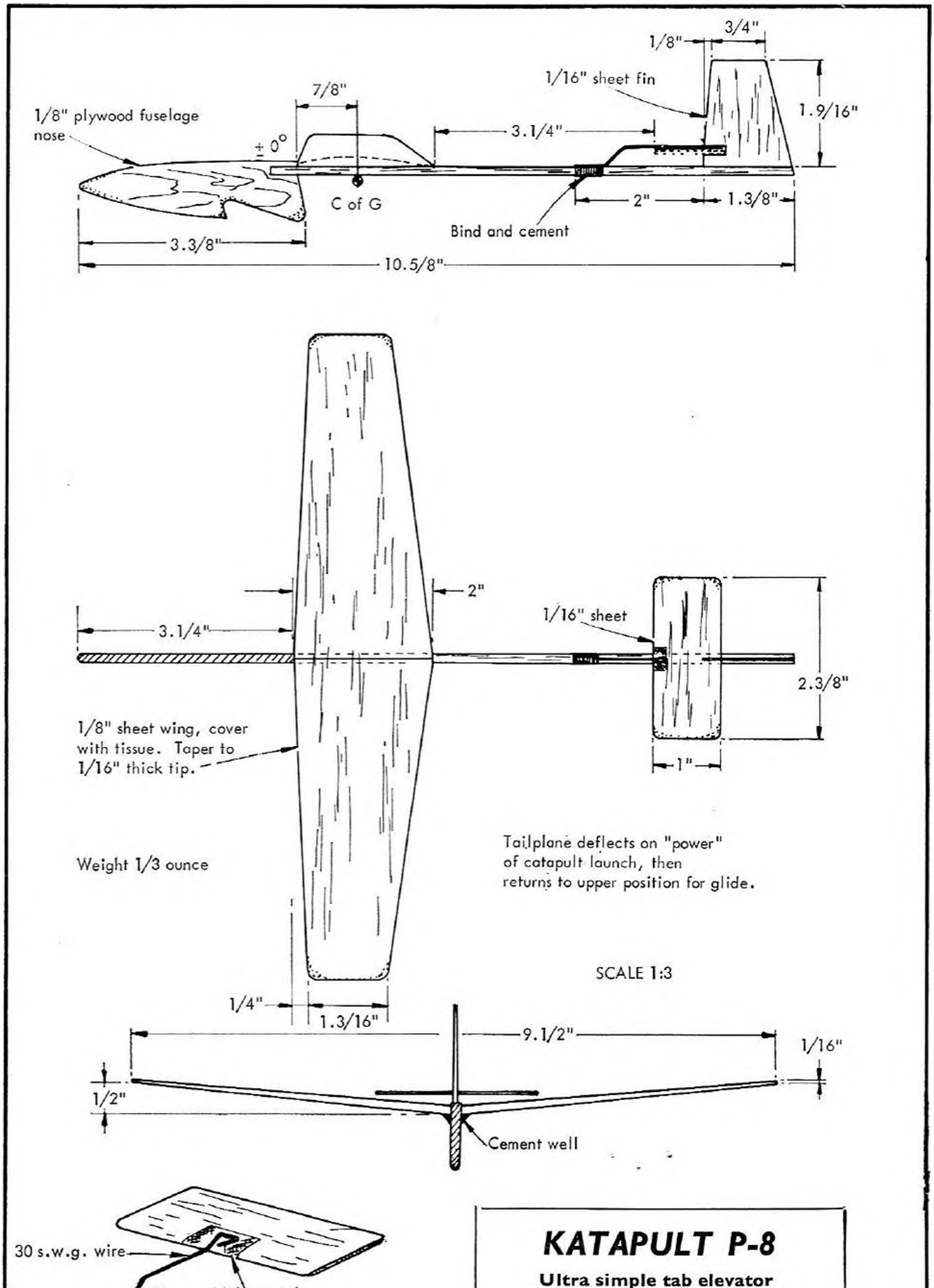
MODELAR, CZECHOSLOVAKIA



MODELLEZES, HUNGARY



MODELARZ, POLAND


3/4"
1/8"
1/16" sheet fin
7/8"
1.9/16"
1/8" plywood fuselage nose
3.1/4"
± 0°
C of G
2"
1.3/8"
Bind and cement
3.3/8"
10.5/8"
2"
3.1/4"
1/16" sheet
2.3/8"
1/8" sheet wing, cover with tissue. Taper to 1/16" thick tip.
1"
Weight 1/3 ounce
Tailplane deflects on "power" of catapult launch, then returns to upper position for glide.
SCALE 1:3
1/4"
1.3/16"
9.1/2"
1/16"
1/2"
Cement well
30 s.w.g. wire
Nylon patch
Bind and cement
Fuselage
Sprung Tailplane Unit.
KATAPULT P-8
Ultra simple tab elevator controlled high speed Launch glider
By ANDRE THUROCZY

W. Neuman mascot is prominent in photograph of "Jefe" the World Championship holding Team Racer operated by Herb Stockton (mechanic No. 165) and Don Jehlik (pilot No. 166). Plans for Jefe are available through Aeromodeller Plans Service, price 5/6 including post, quote number CL/932 when ordering.

CONTROL-LINE WORLD CHAMPIONSHIPS Held at R.A.F. Swinderby, England August 26th-30th, 1966

Winning team gets deserved acclamation at R.A.F. Swinderby after one of the closest finals ever witnessed in team racing, only one second separated the leaders.

World Aerobatic Champion Josef Gabris and his "Super Master" 55 in. design with M.V.V.S. 5.6 c.c. engine. Plans for this model are available through A.P.S. as CL 930, price 10/-.

SPEED

			Round 1 Km/h	m.p.h.	*Round* 2 Km/h	m.p.h.	*Round* 3 Km/h	m.p.h.
1	Wisniewski, W. ...	U.S.A.	258·99	160·93			—	
2	Theobald, R.	U.S.A.	241·61	150·13	—		—	
3	Schuette, C.	U.S.A.	226·42	140·69	226·42	140·69	222·22	138·08
11	**Lindsey, K.**	**Great Britain** ...	—		218·18	135·57	177·34	110·19
15	**Firbank, W.**	**Great Britain** ...	213·02	132·36	—		—	
21	**Jackson, B.**	**Great Britain** ...	210·53	130·81	—		210·53	130·81

TEAM RACING

			Round 1	*Round* 2	*Final*
1	Stockton/Jehlik	U.S.A.	4·28	4·25	9·22
2	Hohenberg/Turk	Austria	4·33	—	9·23
3	Sharovalov/Radchenko	U.S.S.R.	5·22	4·25	10·35
4	Gurtler/Klemm	Czechoslovakia	4·36	6·10	
5	**Turner/Hughes**	**Great Britain**	6·35	4·42	

AEROBATICS

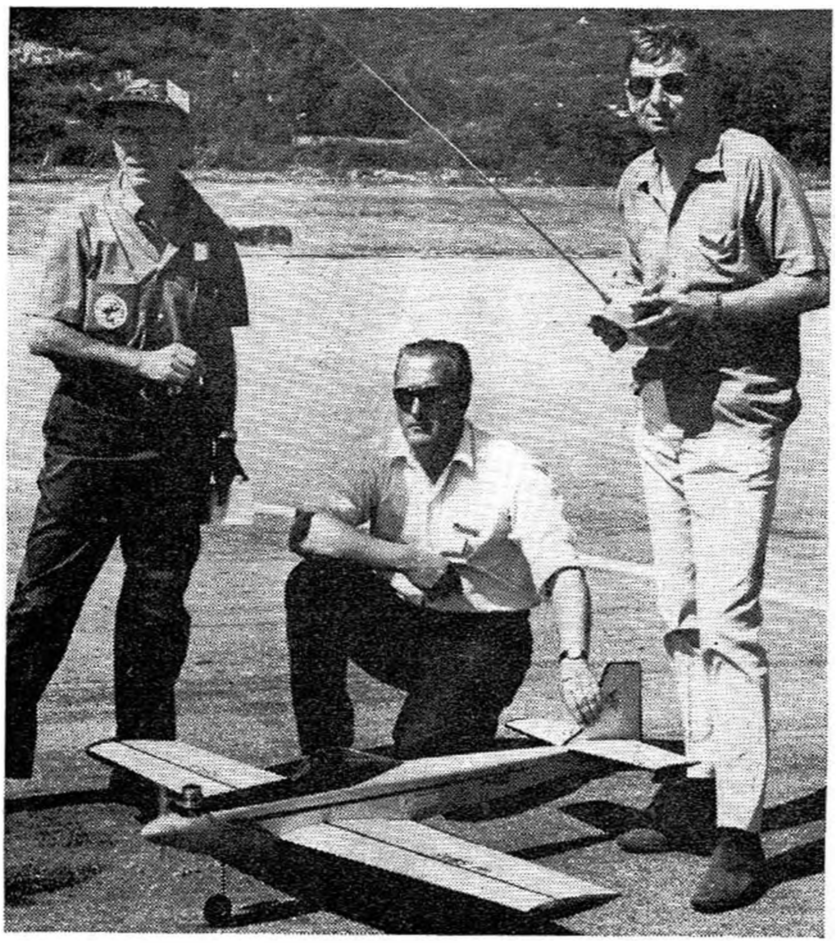
			Round 1	*Round* 2	*Round* 3	*Total*
1	Gabris, J.	Czechoslovakia ...	2539	2917	3096	6013
2	Silhavey, J.	U.S.A.	2384	2870	3012	5882
3	McFarland, L.	U.S.A.	2635	2886	2992	5878
4	Wooley, S.	U.S.A.	2690	2766	2947	5713
5	Karl, J.	Finland	2753	2715	2835	5588
6	v. de Hout L.	Holland	2387	2632	2924	5556
21	**Jolley, T.**	**Great Britain** ...	2356	2115	2361	4710
29	**Dowbekin, H.**	**Great Britain** ...	2323	2174	2194	4517
30	**Mannal, J.**	**Great Britain** ...	2365	2120	2088	4485

SCALE

			Scale Pts.	*Flight*	*Total*	*Model*
1	MacZura, W.	U.S.A.	1258	450	1708	Grumman Bearcat
2	**Day, A.**	**Great Britain** ...	1096	296	1392	Shinn
3	**Ivans, R.**	**Great Britain** ...	767	447	1214	Potez 63
4	Blender, H.	West Germany ...	1017	131	1148	Fokker D7
5	**Perry, S.**	**Great Britain** ...	857	156	1013	Hawker Henley

5th WORLD RADIO CONTROL CHAMPIONSHIP, JUNE 21st—25th AJACCIO, CORSICA

Above: the new World R/C Champion Phil Kraft with his winning model, Kwik Fli III. Phil led the field through all three rounds of the competition. Combined with other two U.S. team members Spreng and Weirick to take top team honours.

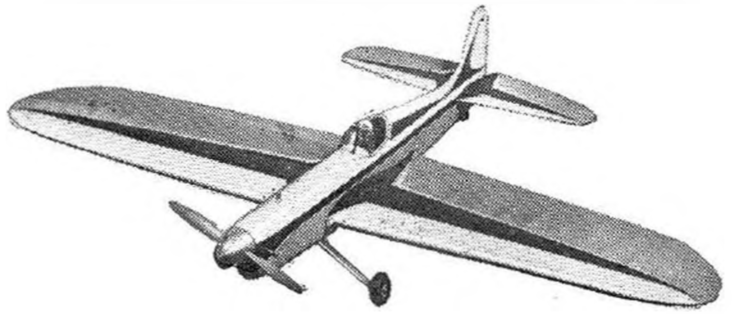


1	P. Kraft, U.S.A.	16.496
2	P. Marrot, France	15.265
3	K. Bauerhelm, Germany	14.875
4	D. Spreng, U.S.A.	14.861
5	W. Schmitz, Germany	14.705
6	W. Matt, Liechtenstein	14.411
7	C. Sweatman, South Africa	14.354
8	B. Giezendanner, Switzerland	14.236
9	C. Olsen, Great Britain	13.690
23	P. Waters, Great Britain	11.278
32	D. Hammant, Great Britain	7.953

Team Places

1	U.S.A.	44.941
2	W. Germany	40.723
3	South Africa	39.171
4	France	38.843
5	Switzerland	33.130
6	Great Britain	32.921

Top British competitor Chris Olsen who was placed 9th. Seen here with team manager Geoff Franklin holding model and Dr. Walter Good awaiting signal from monitor van, checking for interference which was an unfortunate feature of the meet.



KEIL-KRAFT, VERON, FROG, MERCURY, TOP FLITE, GOLDBERG, GRAUPNER, STIRLING, ARIEL R/C F. & M. MACGREGOR, GRUNDIG, O.S. MINITRON, SKY-LEADER R/C, ETA, OLIVER, E.D. MERCO, D.C., ENYA, O.S.

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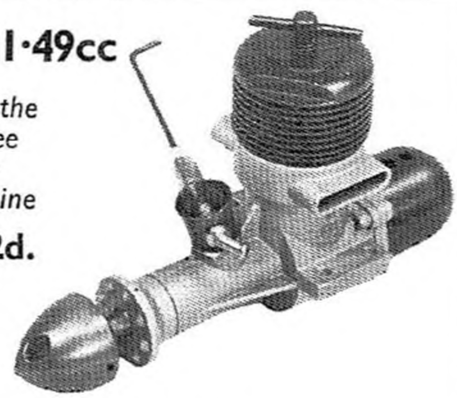

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Standard version, the ideal choice for free flight scale models and sport control-line

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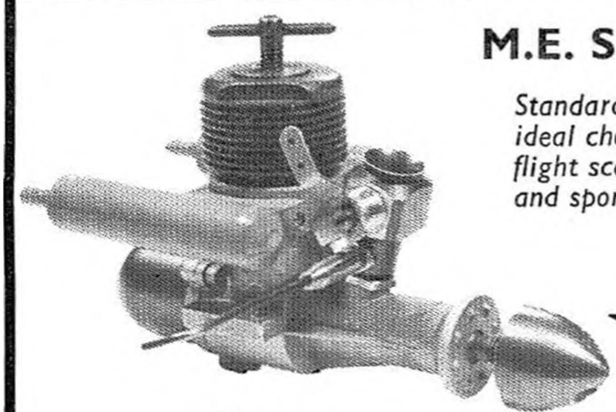

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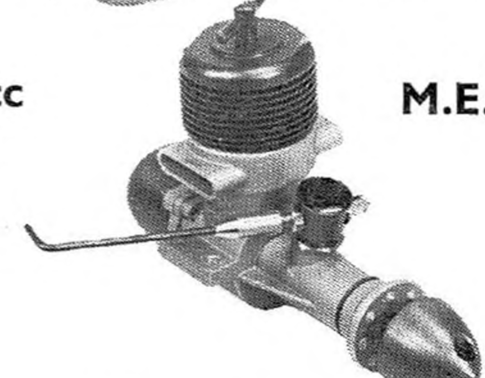

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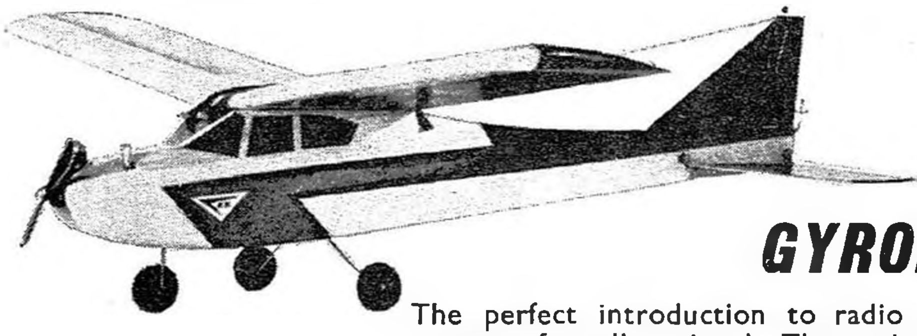
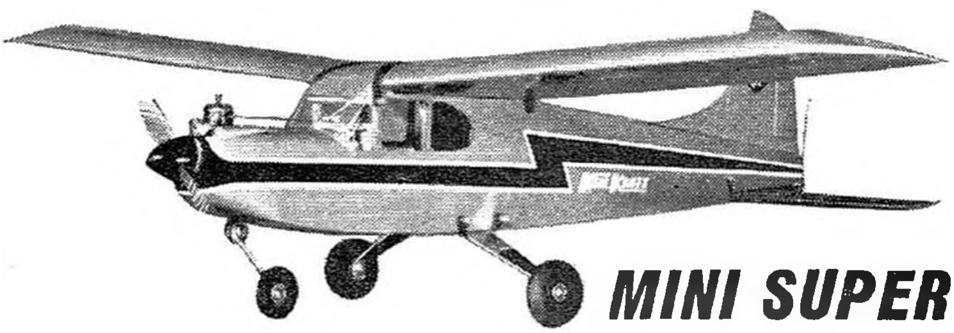


GYRON 36″ span

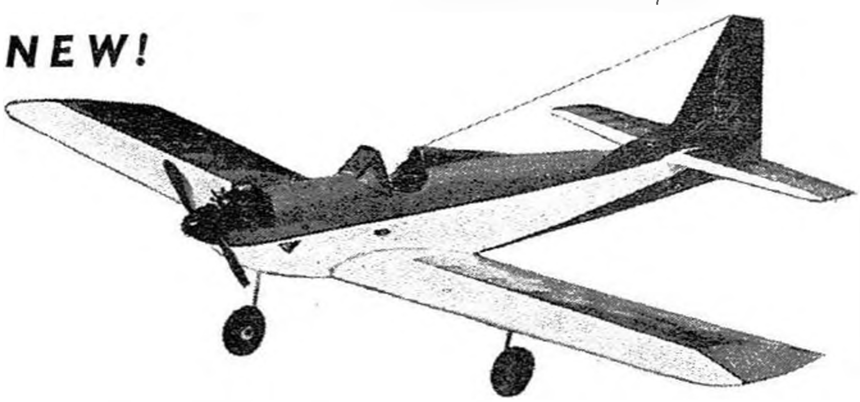
The perfect introduction to radio control flying for the owners of small engines! The entire model is balsa sheet covered for strength, and designed for single channel R/C with .8 c.c. engines. A small, strong, inexpensive model with a performance to please even the most critical! **£3.10.10**



MINI SUPER 48″ span

A real pleasure to build and fly. Kit contents include—all parts pre-cut, metal clunk tank, preformed under-carriage, three sponge rubber wheels, pre-shaped leading edge section, full-size plan for building and flying instructions. Wingspan 48″. For 1.5 to 2.5 c.c. engines. Single channel or intermediate R/C. **£4.19.8**

NEW!



FLEETWING 54″ span

For intermediate multi-radio control, this scalish-looking low wing model is just the job! For motors of 2.5 c.c. upwards.
Price to be announced.

If you're a newcomer to R/C- better buy KEILKRAFT