AEROMODELLER ANNUAL 1955

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AEROMODELLER ANNUAL 1955-56

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

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AEROMODELLER ANNUAL 1949-1955

M O D E L D I E S E L S

CONTROL LINE MODEL AIRCRAFT

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CONTENTS

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Introduction

Accent on Outdoors

THE EXCEPTIONAL summer will make 1955 a year to be remembered joyfully by aeromodellers everywhere who made the most of their opportunities to fly in ideal conditions as never before. Many a club and area were able to stage meetings and rallies which raised revenue enough to bring smiles to the faces of treasurers, and enthused secretaries into ambitious winter activities. Culmination of this great season was undoubtedly the World Championships at Mainz-Finthen, with the USAFE base at Wiesbaden responsible for housing and feeding contestants, which had all the makings of a Model Olympics when some three hundred and fifty persons sat down to the post contest banquet. Attendance proved a record with seventy or more participants in Wakefield, Nordic A/2 and Power events.

Final scores tell their own story—with a seven-fold tie in the Wakefield flown off amid great excitement in the fading light: a tie again in the Power event and only the Glider contest going outright to Lindner of Germany, repeating his victory of 1954. Great Britain showed prominently with Michael Gaster a worthy Power winner and the British team in first place. Robert Gilroy only failed by six seconds to take the A/2 event from the formidable German.

Earlier in the year British entries in the Radio Control contest at Essen Mulheim and the Speed Control Line meeting in Paris by no means disgraced themselves, though in the latter event they were competing against what were virtually "professional" teams entered by some countries.

At home, research and the development of new projects had to take very definite second place to active flying, but there were, nevertheless, significant advances. The introduction of regular helicopter services has encouraged an increased interest in this form of motive power, so that some very curious rotating wing designs made an appearance, and at the same time efforts were devoted to producing more orthodox versions of this type of flight.

Progress in the field of ducted fan propulsion advanced to the stage when leading experimenters could look back on more than a score of models built and flown—so that in all nearly a hundred experimental scale models must have been airborne. Most successful of this type were those produced by P. E. Norman, and we are happy to be able to pass on his findings in this edition of AEROMODELLER ANNUAL.

Equally interesting was the revolt of a group of contest power modellers against the tyranny of the pylon; again we offer an article by their leading protagonist, Jim Waldron, discussing his shoulder wing and similar types. Once again C. Rupert Moore, A.R.C.A., has produced our dust-cover, frontispiece and colour insert, and our blockmakers are to be congratulated on providing such fine reproductions of the originals.

This year there has been so much that was worthwhile to squeeze into the ANNUAL that we have made minor changes in layout to accommodate a little more material. We present our yearly offering with the usual words of thanks to the many who have contributed to its contents, and hope it will please our sternest critics—our readers.

INTERNATIONAL RADIO CONTROL CONTEST, ESSEN-MULHEIM, GERMANY

KING OF THE BELGIANS CUP 1955

RESULTS

No.	*Name*	*Country*	*Points*
1	Gobeaux, J. P.	Belgium	459½
2	Stegmaier, K.	Germany	359½
3	De Hertogh	Belgium	244½
4	Hemsley, O. E.	Gt. Britain	219½
5	Lichius, H.	Germany	210½
6	Wastable, A.	France	173½
7	Honnest-Redlich	Gt. Britain	94
8	Schenker	Switzerland	13½

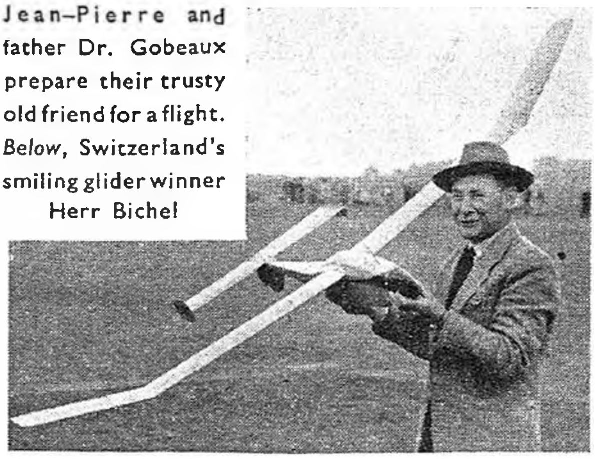
Glider event

No.	*Name*	*Country*	*Points*
1	Bichel	Switzerland	143½
2	Osmer	Germany	122
3	Seifert	Germany	98
4	Mabille	Belgium	85
5	Fischer	Switzerland	20

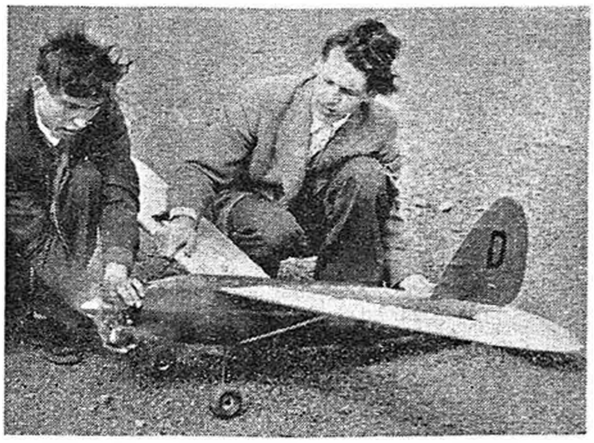
Rudder only

No.	*Name*	*Country*	*Points*
1	Laiy	Belgium	205½
2	Kurth	Germany	202
3	Dobbeleer	Belgium	184½

Jean-Pierre and father Dr. Gobeaux prepare their trusty old friend for a flight. *Below*, Switzerland's smiling glider winner Herr Bichel



Below, Last year's winners and runners-up in 1955—the Stegmaier brothers



World Control Line Championships

PARIS, FRANCE

1955 WORLD SPEED CHAMPIONSHIP CLASS (2.5 c.c.)

Placing	*Name*	*Country*	*Engine*	*Speed*
				m.p.h.
1	Sladky, J.	Czechoslovakia ...	SK-25	111.3
2	Prati, A.	Italy	Super Tigre ...	109.4
3	Monti, S.	Italy	Super Tigre ...	108.7
4	Cappi, C.	Italy	Super Tigre ...	108.2
5	Zatochil, M. ...	Czechoslovakia ...	MVVS 25	106.3
6	Gottarelli, G. ...	Italy	Super Tigre ...	106.3
7	Ericsson, O. ...	Sweden	Webra Mach I ...	105
8	Fresl, E.	Jugoslavia ...	K & B 15	101.3
9	Edmonds, R. ...	Gt. Britain ...	Webra Mach I (G)	100.7
10	Wright, L. P. ...	Gt. Britain ...	E.D. Racer (G) ...	99.4
11	Smejkal, V.... ...	Czechoslovakia ...	MVVS 25	98.2
12	Busch, G.	Germany... ...	Webra Mach I ...	97
13	Couprie, F.... ...	France	Oliver Tiger ...	96.3
14	Grulich, B. ...	Czechoslovakia ...	MVVS 25	95.1
	Gibbs, R.	Gt. Britain ...	Carter	95.1
16	Kreulen, E. ...	Holland	Webra Mach I ...	93.3
	Eliasson, P. A. ...	Sweden	Webra Mach I ...	93.3
	Gordyn, M. J. ...	Holland	Webra Mach I ...	93.3
19	Bodemann, G. ...	Germany... ...	Webra Mach I ...	92.5
20	Janssens, J. ...	Belgium ...	Super Tigre ...	90.1
21	Vujic, M.	Jugoslavia ...	Aero 250	88.9
22	Prukner, T. ...	Jugoslavia ...	E.D. 2.46	88.3
23	Frolich, J.	Germany... ...	Webra Mach I ...	87.6
24	Hie, S.	France	K & B 15	84.5
25	Stouffs, H.	Belgium ...	E.D. 2.46	83.3
	Andersen, P. C. ...	Denmark... ...	Webra Mach I ...	83.3
27	Hansen, B. ...	Denmark... ...	E.D. 2.46	82.6
28	Hansen, J. K. ...	Denmark... ...	E.D. 2.46	80.7
	Woods, D.	Gt. Britain ...	K & B 15	80.7
30	Labarde, R. ...	France	Micron 15	79.5
31	Madsen, E. B. ...	Denmark... ...	E.D. 2.46	73.9
32	Godden, W. ...	U.S.A.	K & B 15	67.7
33	Lutker, R. ...	U.S.A.	K & B 15	56.6

TEAM RESULTS

1	Italy	525
2	Czechoslovakia	506
3	Gt. Britain	475
4	Jugoslavia	448
5	Germany	446
6	France	419
7	Denmark	397
8	Sweden	319
9	Holland	300
10	Belgium	279
11	U.S.A....	200

F.A.I. CUP : AEROBATICS

1	Humbertjean, J.	France	Fox 35
2	Lutker, R.	U.S.A.	K & B 29
3	Laniot, G.	France	Micron 29

A seven-fold tie for the Wakefield Cup ended the most exciting contest ever. Inthe fly-off to determine who enjoyed actual custody of the trophy for the ensuing year G. Samann proved the lucky man, and appears here with his highly developed model.

1955 INTERNATIONAL WAKEFIELD CONTEST
Held at Mainz-Finthen, Germany

No.	Name	Country	1	2	3	4	5	Total
1	Samann G. ...	Germany ...	180	180	180	180	180	900+315
	Hakansson, A. I.	Sweden ...	180	180	180	180	180	900+289
	Scardicchio, V.	Italy	180	180	180	180	180	900+286
	Altmann, J. ...	Germany ...	180	180	180	180	180	900+284
	Fresl, E.	Yugoslavia ...	180	180	180	180	180	900+270
	Fea, G. ...	Italy	180	180	180	180	180	900+213
	Muzny, L. ...	Czechoslovakia	180	180	180	180	180	900+169
8	Blomquist, M. U.	Sweden ...	180	180	180	172	180	892
9	Widell, K. E. ...	Denmark ...	180	180	180	180	172	890
	Ahman, R. G. ...	Sweden ...	180	170	180	180	180	890
11	Holland, F. ...	Great Britain ...	180	180	180	180	160	880
	Champine, R. A.	United States	180	180	180	179	161	880
13	Kothe, H. H. ...	United States	180	180	180	158	180	878
14	Mursep, F. ...	Argentina ...	164	180	180	173	180	877
15	O'Donnell, H. ...	Great Britain ...	180	180	156	180	180	876
16	Balasse, E. ...	Belgium ...	180	180	180	149	180	869
	de Vries, C. R. ...	Holland ...	180	180	180	159	170	869
18	Andrade, M. D....	United States	180	180	180	148	180	868
19	Maibaum, G. ...	Germany ...	180	180	147	180	180	867
20	Schaap, G. J. ...	United States	180	180	180	180	146	866
21	van Galantha, A. S.	Holland ...	180	143	180	180	180	863
	de Bare, O. ...	Belgium ...	180	180	180	143	180	863
23	Kmoh, V. ...	Yugoslavia ...	141	180	180	180	180	861
24	Cizek, R.... ...	Czechoslovakia	178	180	132	180	180	850
25	Geer, H. J. v. d.	Netherlands ...	148	180	180	177	158	843
	Toersen, H. ...	Holland ...	180	125	180	179	179	843
27	Knudsen, E. ...	Denmark ...	180	174	136	168	180	838
28	Johansson, R. K. E.	Sweden ...	180	180	117	180	180	837

No.	Name	Country	1	2	3	4	5	Total
29 ...	Prandini, D.	Italy... ...	180	180	180	114	180	834
	O'Donnell, J. ...	Great Britain	180	180	114	180	180	834
31 ...	Mackenzie, D. R. ...	Canada ...	180	158	133	180	180	831
32 ...	McGlashan, R. (*P*) ...	Canada ...	175	122	180	172	180	829
33 ...	Bodmer, M.	Switzerland	162	180	160	160	165	827
34 ...	Gerlaud, E.	France ...	105	180	180	180	180	825
35 ...	Pietralunga, I. ...	Italy... ...	180	115	180	148	180	803
	Miyahara, R. (*P*) ...	Japan ...	156	164	173	180	180	803
37 ...	Read, P. W. ...	Great Britain	139	165	136	180	180	800
38 ...	Murtagh, L. F. ...	Ireland ...	125	180	180	180	129	794
39 ...	Baker, B. R. S. ...	Australia ...	180	154	114	180	165	793
40 ...	Ljubomir, N. ...	Yugoslavia ...	103	180	157	167	180	787
41 ...	Nienstedt, E.	Denmark ...	180	144	180	98	180	782
42 ...	Corwell, N.	Ireland ...	108	180	180	180	133	781
43 ...	Chevrlot, M. ...	France ...	180	180	180	123	113	776
44 ...	Conzalez, R. E. ...	Argentina ...	180	173	121	144	153	771
45 ...	Parnisari, J. C. ...	Argentina ...	180	151	125	180	127	763
46 ...	Hemola, J.	Czechoslovakia	149	180	70	180	180	759
47 ...	Morisset, J.	France ...	180	172	145	134	127	758
48 ...	Hyttrek, O.	Germany ...	173	156	110	122	176	737
49 ...	Leong, A. (*P*)... ...	New Zealand	118	180	131	115	180	724
50 ...	Upton, J. (*P*) ...	New Zealand	180	151	70	156	163	720
51 ...	Mikami, Y. (*P*) ...	Japan ...	180	145	180	104	110	719
52 ...	Goetz, C.	France ...	78	180	122	180	155	715
53 ...	Ure, V. H. (*P*) ...	Canada ...	180	113	127	180	114	714
54 ...	Sorensen, N. W. ...	Denmark ...	155	131	180	104	143	713
55 ...	Djorde, J. A.	Yugoslavia	171	144	180	114	89	698
56 ...	Kimura, M. (*P*) ...	Japan ...	110	180	137	140	108	675
57 ...	Lippens, G.	Belgium ...	109	180	121	125	121	656
58 ...	Mach, Z.	Czechoslovakia	147	180	—	155	172	654
59 ...	Bird, R. E. (*P*) ...	Australia ...	170	180	48	60	180	638
60 ...	Rizzi, V. J.	Argentina ...	27	109	106	180	180	602
61 ...	Miyoshi, K. (*P*) ...	Japan ...	180	98	103	48	158	587
62 ...	Walter, L. J. (*P*) ...	Canada ...	125	47	180	128	105	585
63 ...	King, A. D.	Australia ...	180	151	170	69	—	576
64 ...	Ackroyd, L. R. G. (*P*) ...	New Zealand ...	—	180	114	180	—	474
65 ...	Gordon, A.	Ireland ...	—	103	99	64	145	411
66 ...	McElwain, B. R. (*P*) ...	New Zealand ...	—	133	113	89	—	337
67 ...	Boughten, D. R.	Australia ...	—	—	—	180	137	317
68 ...	Hourrelle, H.	Belgium ...	92	—	64	68	91	315
69 ...	Thompson, J. D.	Ireland ...	—	38	104	47	57	246
70 ...	Aubertin, R. M.	Monaco ...	—	10	—	—	—	10

P indicates flown by proxy.

TEAM RESULTS

1	Sweden ...	2682
2	Germany ...	2667
3	United States	2646
4	Italy	2634
5	Great Britain	2590
6	Holland ...	2575
7	Yugoslavia ...	2548
8	Denmark ...	2510
9	Czechoslovakia	2509
10	Argentina ...	2411
11	Belgium ...	2388
12	Canada ...	2374
13	France ...	2359
14	Japan ...	2197
15	Australia ...	2007
16	Ireland ...	1986
17	New Zealand	1918
18	Switzerland	827
19	Monaco ...	10

Triumphant trio which tied for first place in the Power Championship, necessitating a fly-off. Michael Gaster of Gt. Britain wears the smile of ultimate victory and is flanked on his right by F. Stajcer, Argentine, second man, and on his left by B. Jones of Canada, who took third place.

1955 WORLD POWER CHAMPIONSHIPS FOR F.N.A.F.O.M. CUP

Held at Mainz-Finthen, Germany

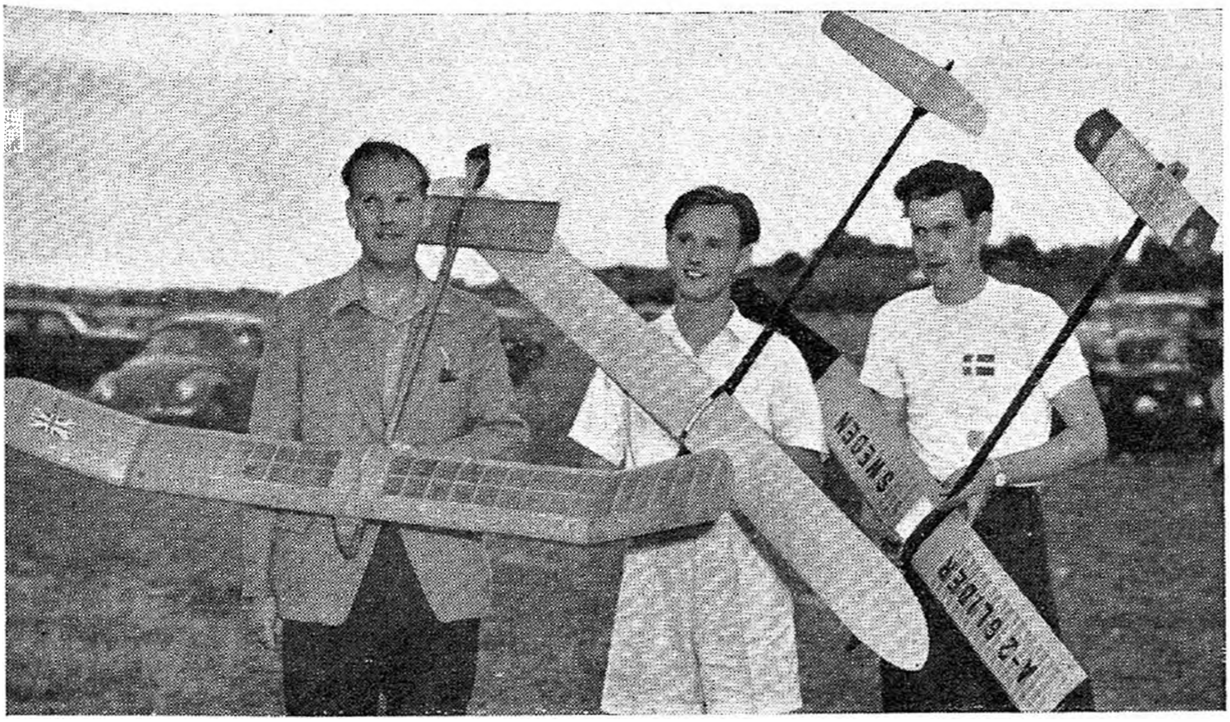
No.	Name	Country	1	2	3	4	5	Total
1 ...	Gaster, M.	Great Britain	180	180	180	180	180	900 + 313
2 ...	Stajcer, F.	Argentina ...	180	180	180	180	180	900 + 175
3 ...	Jones, B.	Canada ...	180	180	180	180	180	900
4 ...	Hajek, V.	Czechoslovakia	180	180	180	180	166	886
	Mangino, L.	Mexico ...	166	180	180	180	180	886
6 ...	Buskell, P.	Great Britain	180	180	180	180	151	871
7 ...	Vidossich, G. ...	Italy... ...	180	180	180	180	150	870
8 ...	Rudolph, M. ...	Germany ...	179	180	166	180	164	869
9 ...	Goss, O.	United States	180	180	148	180	178	866
10 ...	Bausch, L. F. L. M....	Holland	160	180	180	180	127	827
	Podda, A.	Italy... ...	170	142	180	180	155	827
12 ...	Partinen, J.	Finland ...	132	180	158	180	167	817
13 ...	Gould, H.	United States	180	180	142	180	130	812
14 ...	Bacchi, R.	Italy... ...	180	180	180	174	87	801
	Gunic, B.	Yugoslavia ...	180	180	81	180	180	801
16 ...	Parrott, J.	Great Britain	180	180	102	180	143	785
17 ...	Heidemann, J. ...	Germany ...	120	180	173	180	176	779
18 ...	Hormann, G. ...	Austria ...	180	169	133	180	102	764
19 ...	Lucas, O.	Argentina ...	162	180	60	180	180	762
	Thompson, J.... ...	Ireland ...	150	127	125	180	180	762
21 ...	Ziot, M.	Argentina ...	180	155	111	180	134	760
22 ...	Davila, S.	Mexico ...	180	125	129	166	157	757
23 ...	Aiken, F.	Ireland ...	180	154	180	165	74	753

No.	Name	Country	1	2	3	4	5	Total
	Johansen, E.	Denmark	157	132	104	180	180	753
25	Rupp, G.	Germany	169	108	109	180	180	746
26	Fresl, E.	Yugoslavia	180	130	95	151	180	736
27	Fries, H.	Sweden	144	180	160	180	69	733
28	Nesic, L.	Yugoslavia	147	76	147	180	180	730
29	Lippens, G.	Belgium	136	152	180	180	81	729
30	Schmitter, P.	Switzerland	154	180	123	180	91	728
31	Hartill, W.	United States	135	100	180	180	113	708
32	Baker, B.	Australia	180	153	101	114	158	706
33	Buhr, H.	Switzerland	118	90	180	180	137	705
34	Mussell, A.	Great Britain	180	156	—	180	180	696
35	Cerny, R.	Czechoslovakia	159	99	143	110	180	691
36	McMillan, J. (*P*)	Canada	79	180	136	153	139	687
37	Lundin, A.	Sweden	102	132	180	180	90	684
38	Morelli, T.	Ireland	115	137	180	142	109	683
39	Entzeroth, H.	Switzerland	148	119	180	103	104	654
40	Etherington, W.	Canada	173	49	143	156	131	652
41	Schenker, R.	Switzerland	137	133	67	117	174	628
42	S'Jongers, J.	Belgium	172	180	103	71	95	621
43	Giudici, G.	France	180	97	117	119	92	605
44	Loser, H.	Germany	15	180	120	180	109	604
45	Hagel, R.	Sweden	7	138	180	180	96	601
46	Navarro, G.	France	100	130	91	142	121	584
47	Bergamaschi, C.	Italy	117	167	95	108	76	563
	Shailor, E.	United States	—	124	79	180	180	563
49	Das, R.	Holland	172	79	89	101	115	556
50	Vondruska, M.	Czechoslovakia	137	180	69	86	67	539
51	Nielsen, H.	Denmark	78	115	83	142	113	531
52	Guyot, J. C.	France	—	152	180	44	151	527
53	Pouliquen, J.	France	88	60	180	37	152	517
54	Teunissen, A. A.	Holland	171	85	—	127	123	506
55	Woodworth, G.	Ireland	137	56	112	67	88	460
56	Sussdorf, F.	Saar	107	—	180	80	83	450
57	Balasse, E.	Belgium	95	79	180	—	88	442
58	Molinari, R.	Monaco	141	—	95	107	30	373
59	Czepa, O.	Austria	58	164	42	68	34	366
60	Zigic, G.	Yugoslavia	180	180	—	—	—	360
61	Waldhauser, H.	Saar	—	76	—	180	94	350
62	Cornelissen, G. M.	Holland	—	72	74	79	115	340
63	De Cosio, C.	Mexico	150	—	—	79	105	334
64	Libert, M.	Belgium	45	75	41	71	68	300
65	Verges, J.	Mexico	—	180	34	42	9	265
66	Graves, J. (*P*)	Canada	108	—	—	51	57	216
67	Blasche, E.	Austria	—	92	—	110	—	202
68	Aubertin, C.	Monaco	137	10	—	—	—	147
69	King, A.	Australia	69	—	—	—	—	69
70	Hillcoat, F.	Argentina	43	2	—	—	—	45
71	Skalla, G.	Austria	9	—	—	—	—	9
72	Aubertin, R.	Monaco	8	—	—	—	—	8

P indicates flown by proxy.

TEAM RESULTS

1	Great Britain	2556	8	Ireland	2198	15	France	1716
2	Italy	2498	9	Czechoslovakia	2116	16	Austria	1332
3	Argentina	2422	10	Switzerland	2087	17	Denmark	1284
4	Germany	2394	11	Sweden	2018	18	Finland	817
5	United States	2386	12	Mexico	1977	19	Saar	800
6	Yugoslavia	2267	13	Holland	1889	20	Australia	777
7	Canada	2239	14	Belgium	1792	21	Monaco	520



R. Lindner of Germany won the Swedish Glider Cup for the second year, and is seen here in the centre with his model. R. Gilroy of Gt. Britain chased him home to take second place a mere 6 secs. behind, with R. Hagel of Sweden only 3 secs. away from him.

SWEDISH GLIDER CUP WORLD CHAMPIONSHIP
Held at Mainz-Finthen, Germany

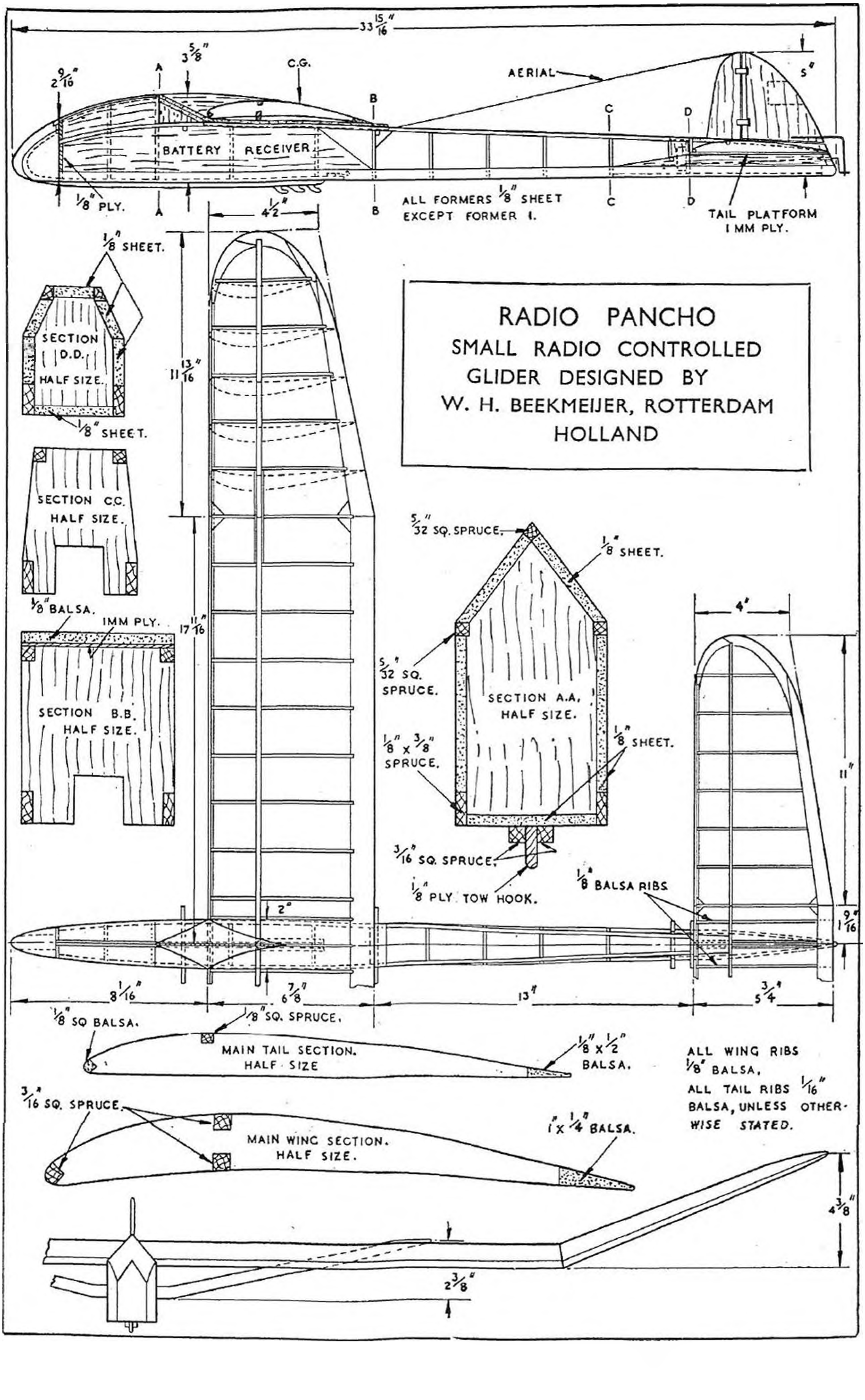
No.	Name	Country	1	2	3	4	5	Total
1	Lindner, R.	Germany	180	180	180	180	166	886
2	Gilroy, R.	Great Britain	160	180	180	180	180	880
3	Hagel, R.	Sweden	176	180	180	164	177	877
4	Giusti, E.	Italy	156	180	180	180	180	876
5	Esvelt, J. C. D.	Holland	163	180	137	180	180	840
6	Thomann, H. W.	Switzerland	166	180	180	180	130	836
7	Kothe, H.	United States	143	180	145	180	180	828
8	Horyna, V.	Czechoslovakia	180	180	133	180	152	825
9	Hansen, H.	Denmark	180	180	158	106	180	804
	Vilchair, M.	France	118	180	180	180	146	804
11	Ege, H.	Switzerland	174	116	180	144	180	794
12	Varetto, C.	Italy	130	180	180	180	114	784
13	Goetz, C.	France	135	100	180	180	180	775
	McElwain, B. (*P*)	New Zealand	104	180	131	180	180	775
15	Overlaet, G.	Belgium	147	180	180	180	85	772
16	Murtagh, L.	Ireland	138	180	180	93	180	771
17	Cavlevski, A.	Yugoslavia	171	165	128	125	180	769
18	Gustafasson, L.	Sweden	141	180	180	90	168	759
19	*O'Donnell, J.*	*Great Britain*	96	*180*	*180*	*180*	*114*	750
20	Feron, L.	Belgium	150	139	180	180	97	746
21	Mackenzie, D.	Canada	130	99	180	156	180	745
22	Spulak, V.	Czechoslovakia	166	95	180	116	178	735
23	Vich, E.	Argentina	110	128	180	147	167	732
24	Sussdorf, F.	Saar	157	180	159	127	106	729
25	Pedersen, S.	Denmark	128	180	139	101	178	726
	Olsson, L.	Sweden	114	180	72	180	180	726

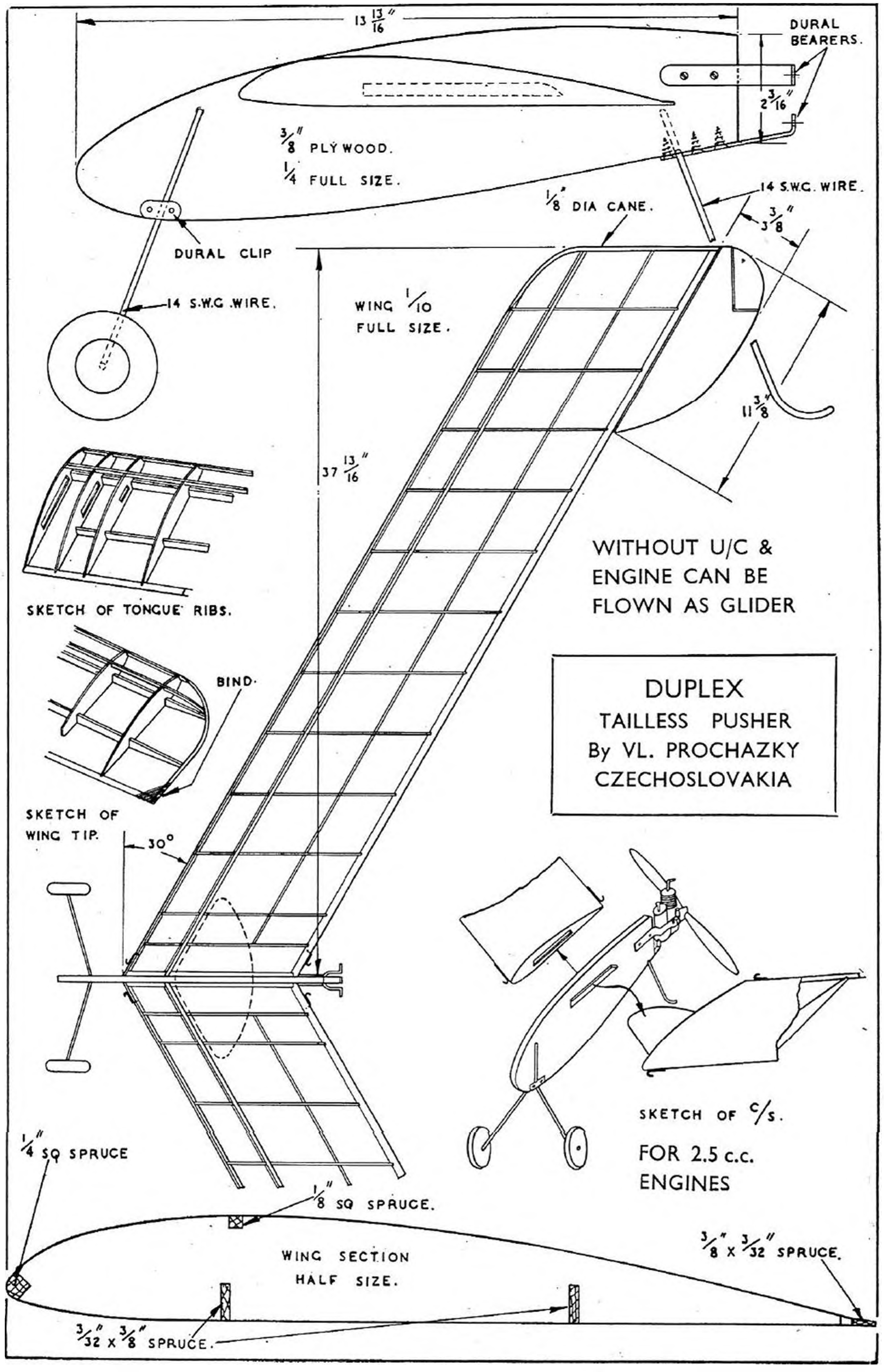
No.	Name	Country	1	2	3	4	5	Total
27	Berthe, R.	France	108	144	180	180	110	722
28	Petrovski, P.	Yugoslavia	180	124	125	108	180	717
29	Boscarol, C.	Italy	140	146	150	178	122	716
30	Lock, J.	France	126	180	90	172	143	711
	LeBreton, A. C. (*P*)	New Zealand	165	180	180	80	106	711
32	Harapat, J.	Czechoslovakia	143	180	180	87	114	704
33	Etherington, W.	Canada	180	151	72	180	115	698
34	Jones, B.	Canada	105	180	101	180	129	695
	Rau, H.	Saar	133	180	180	127	75	695
36	Nironi, P.	Italy	180	84	180	70	176	690
37	Fraquelli, J.	Argentina	132	147	180	153	75	687
38	Newnham, M. (*P*)	Australia	110	109	99	180	180	678
39	Vuletic, M.	Yugoslavia	150	180	78	100	167	675
40	Knoll, R.	Saar	92	180	128	180	83	663
41	Worle, W.	Germany	121	180	69	145	143	658
42	Smith, P.	Ireland	87	180	112	71	180	630
43	Wachter, H. G.	Germany	116	180	83	96	152	627
44	Menc, F.	Czechoslovakia	125	103	180	109	108	625
45	Nielsen, H.	Denmark	80	180	178	98	88	624
46	de Cosio, C.	Mexico	124	180	179	86	54	623
47	Melzer, R.	Germany	113	95	180	47	180	615
48	Aubertin, C.	Monaco	104	176	76	74	180	610
	Klaver, A.	Holland	139	172	82	180	37	610
50	Zito, M.	Argentina	94	87	62	180	180	603
51	Turk, J.	Austria	98	180	30	180	96	584
52	Czepa, O.	Austria	161	161	135	52	67	576
53	Kolb, J.	United States	95	128	180	56	116	575
54	Glavitsch, H.	Austria	131	123	176	20	118	568
55	Cole, H.	United States	121	175	113	93	63	565
56	Sayar, H.	Argentina	107	104	180	106	64	561
	Schnabel, H.	Switzerland	138	180	40	82	121	561
58	Lester, R. B.	Canada	106	180	83	120	71	560
59	Yeabsley, D.	Great Britain	134	101	72	180	67	554
60	Weintraut, H.	Saar	102	173	66	101	47	549
61	Hansen, B.	Denmark	132	117	180	53	64	546
	Lefever, G.	Great Britain	90	167	137	55	97	546
	Bachli, F.	Switzerland	137	180	96	86	47	546
64	Maes, J.	Belgium	178	180	75	29	83	545
65	Kalen, G.	Sweden	115	117	133	75	77	516
66	Walsh, M.	Ireland	131	86	166	82	44	509
67	Wastl, J.	Austria	116	67	45	156	100	484
68	Molinari, R.	Monaco	47	70	180	90	86	473
69	King, A.	Australia	108	114	62	180	—	464
70	Ackroyd, L. R. G. (*P*)	New Zealand	119	119	56	68	96	458
71	Teunissen, A. A.	Holland	114	86	91	64	89	444
72	Aubertin, R.	Monaco	90	133	84	81	49	437
73	Harris, J.	United States	122	90	77	77	56	422
	Pinter, L.	Yugoslavia	63	76	99	61	123	422
75	Adamski, V.	Belgium	103	83	117	83	35	421
76	Thompson, J.	Ireland	87	114	92	54	53	400
77	Luykx, H. B. M.	Holland	126	35	60	58	63	342
78	Carter, P. (*P*)	New Zealand	120	45	27	—	—	192
79	Malcolm, W.	Australia	—	180	—	—	—	180

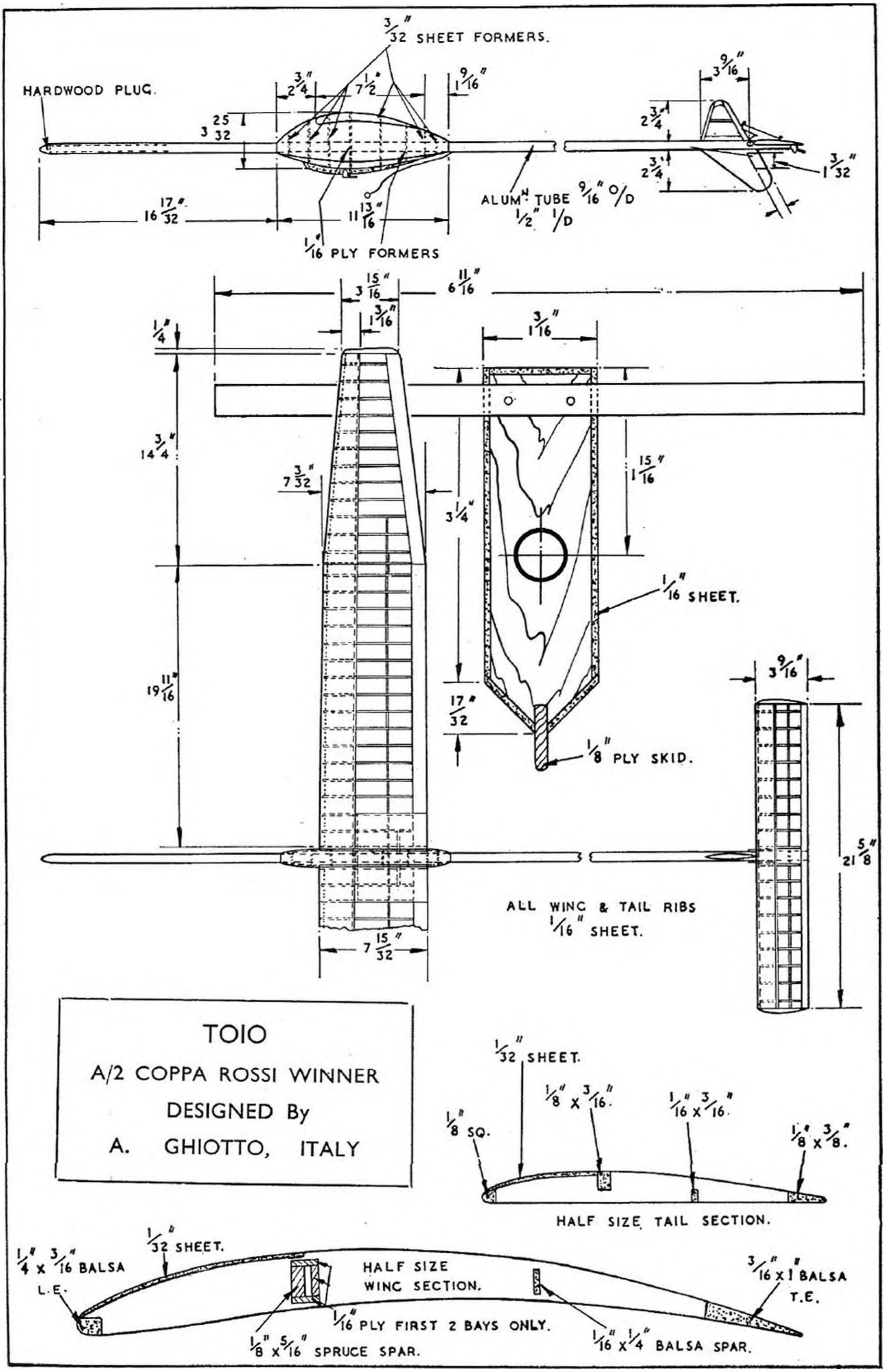
P indicates flown by proxy.

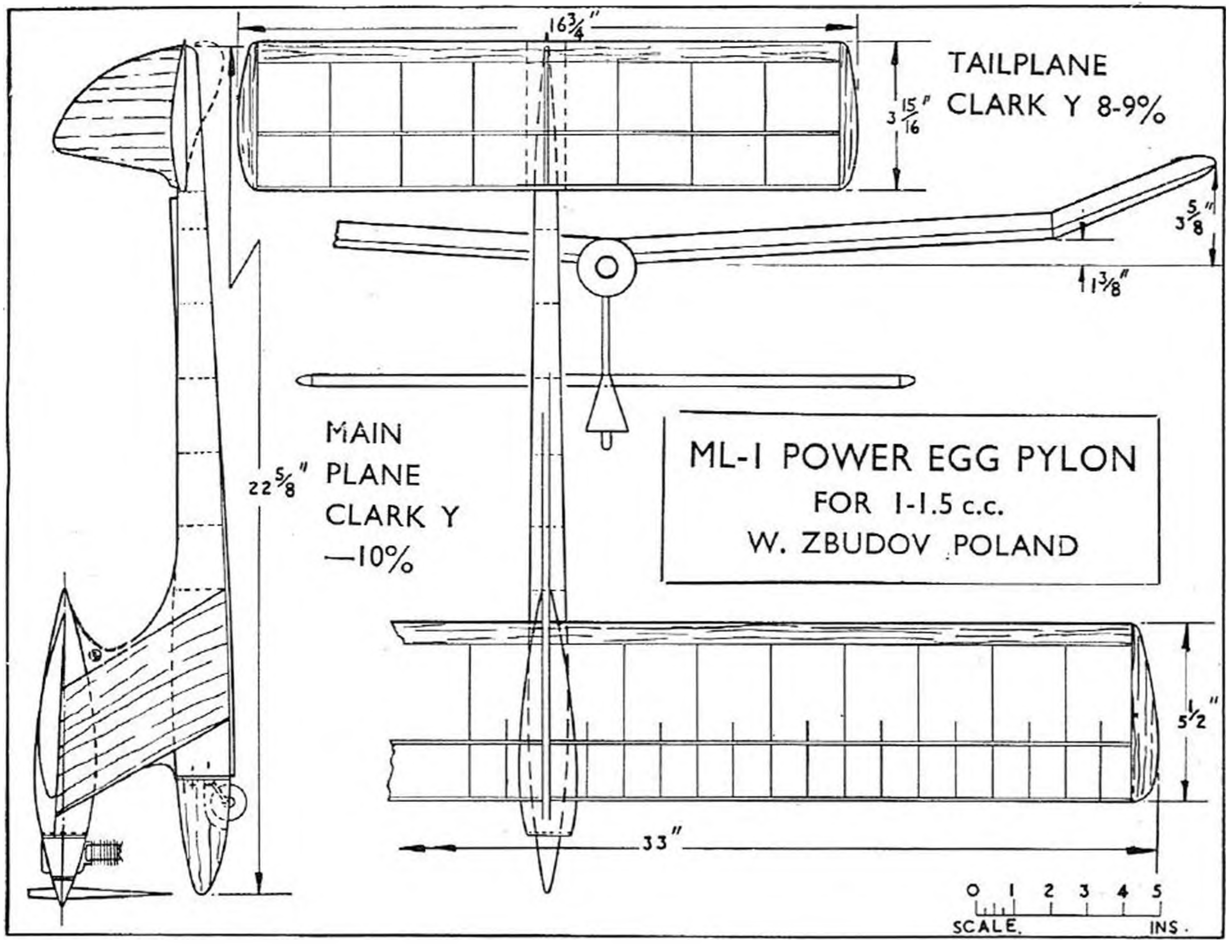
TEAM RESULTS

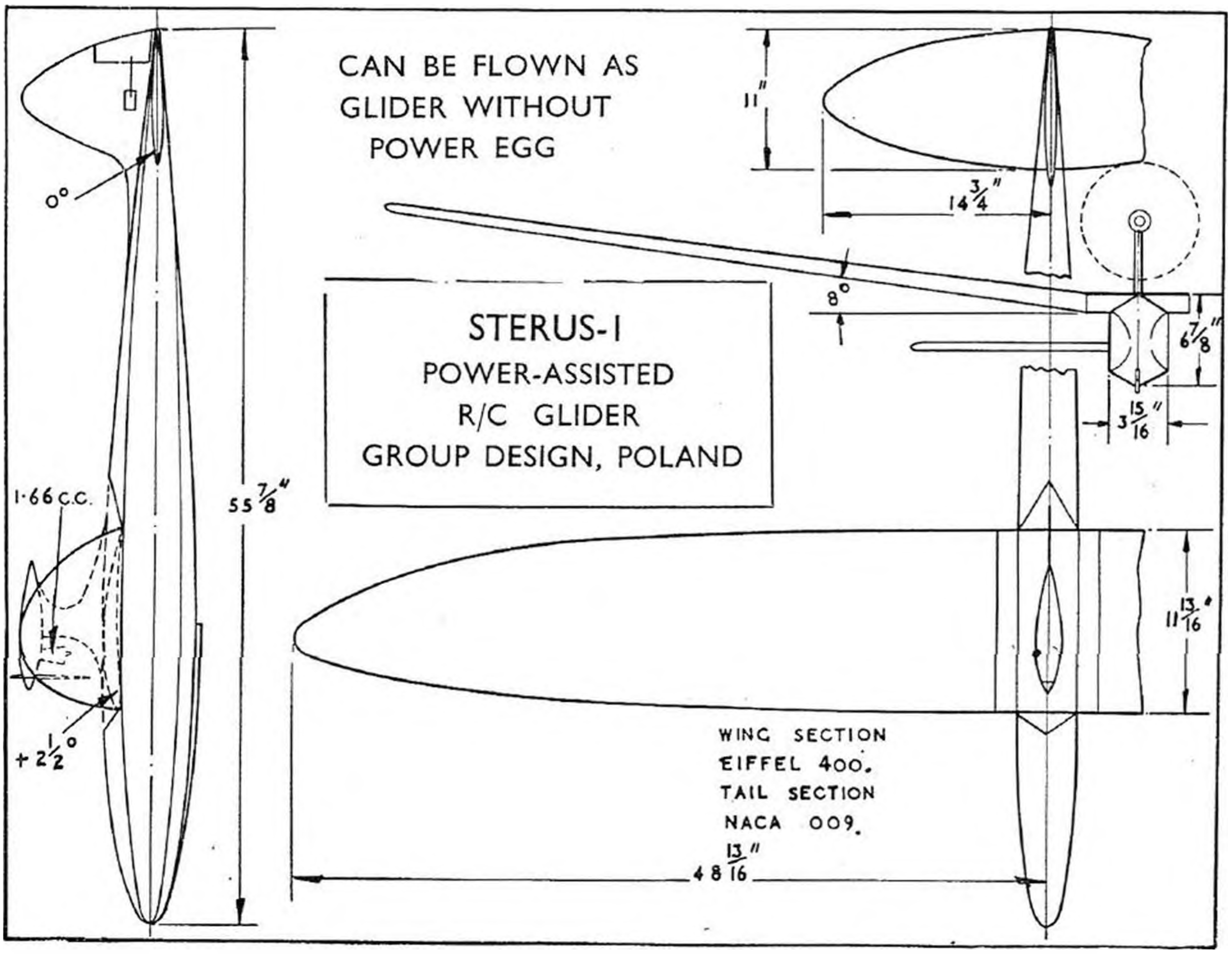
1	Italy	2376	8	Yugoslavia	2161	15	New Zealand	1944
2	Sweden	2362	9	Denmark	2154	16	Ireland	1910
3	France	2301	10	Canada	2138	17	Holland	1894
4	Czechoslovakia	2264	11	Saar	2087	18	Austria	1728
5	Switzerland	2191	12	Belgium	2063	19	Monaco	1520
6	Great Britain	2184	13	Argentina	2022	20	Australia	1322
7	Germany	2171	14	United States	1968	21	Mexico	623

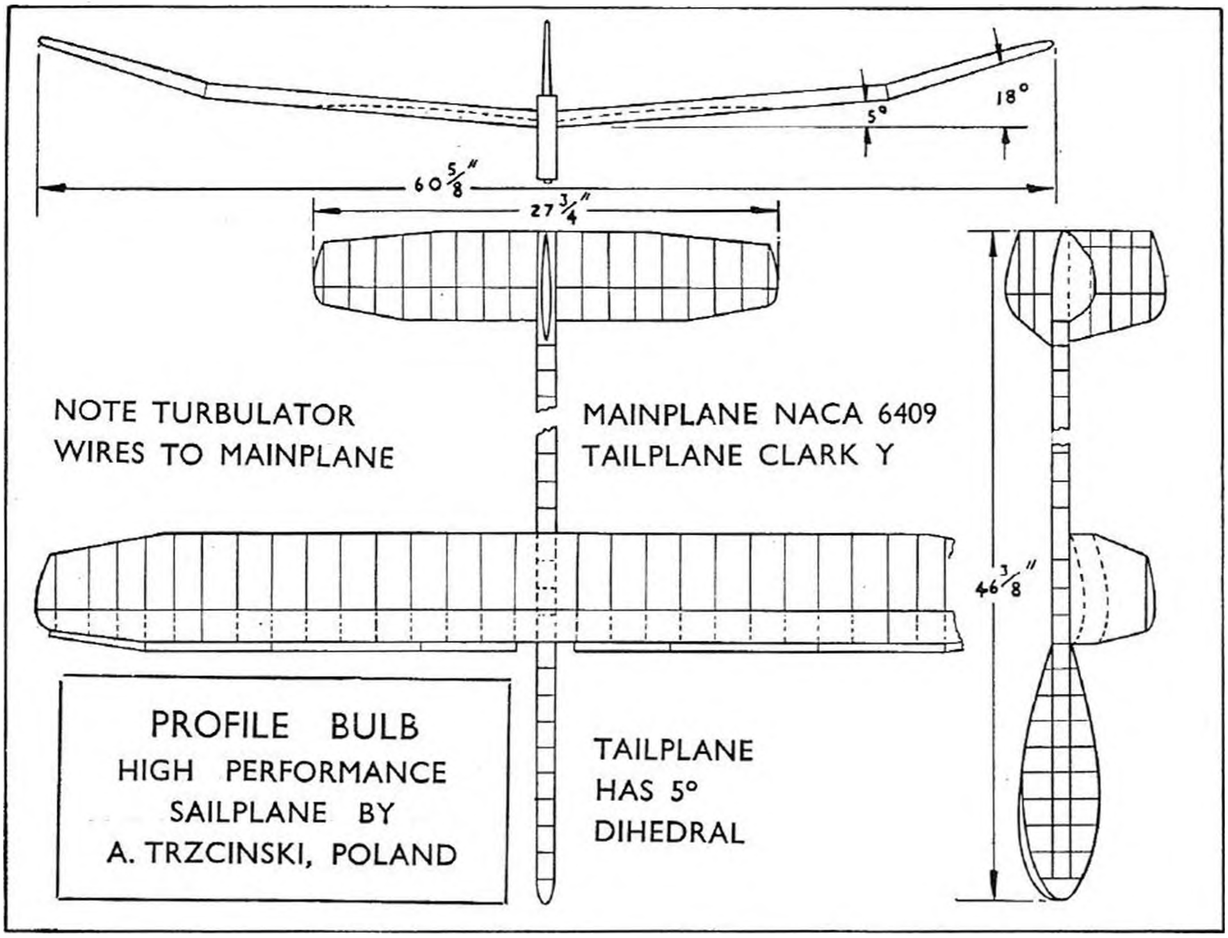

RADIO PANCHO
SMALL RADIO CONTROLLED
GLIDER DESIGNED BY
W. H. BEEKMEIJER, ROTTERDAM
HOLLAND
AERIAL
C.G.
BATTERY
RECEIVER
1/8" PLY.
ALL FORMERS 1/8" SHEET
EXCEPT FORMER 1.
TAIL PLATFORM
1 MM PLY.
1/8" SHEET.
SECTION D.D.
HALF SIZE.
SECTION C.C.
HALF SIZE.
1/8" BALSA.
1MM PLY.
SECTION B.B.
HALF SIZE.
5/32 SQ. SPRUCE.
SECTION A.A.
HALF SIZE.
1/8" x 3/8" SPRUCE.
3/16 SQ. SPRUCE.
1/8 PLY TOW HOOK.
1/8 BALSA RIBS
1/8" SQ BALSA.
1/8" SQ. SPRUCE.
MAIN TAIL SECTION.
HALF SIZE
1/8" x 1/2" BALSA.
ALL WING RIBS
1/8" BALSA,
ALL TAIL RIBS 1/16"
BALSA, UNLESS OTHER-
WISE STATED.
MAIN WING SECTION.
HALF SIZE.
1" x 1/4" BALSA.

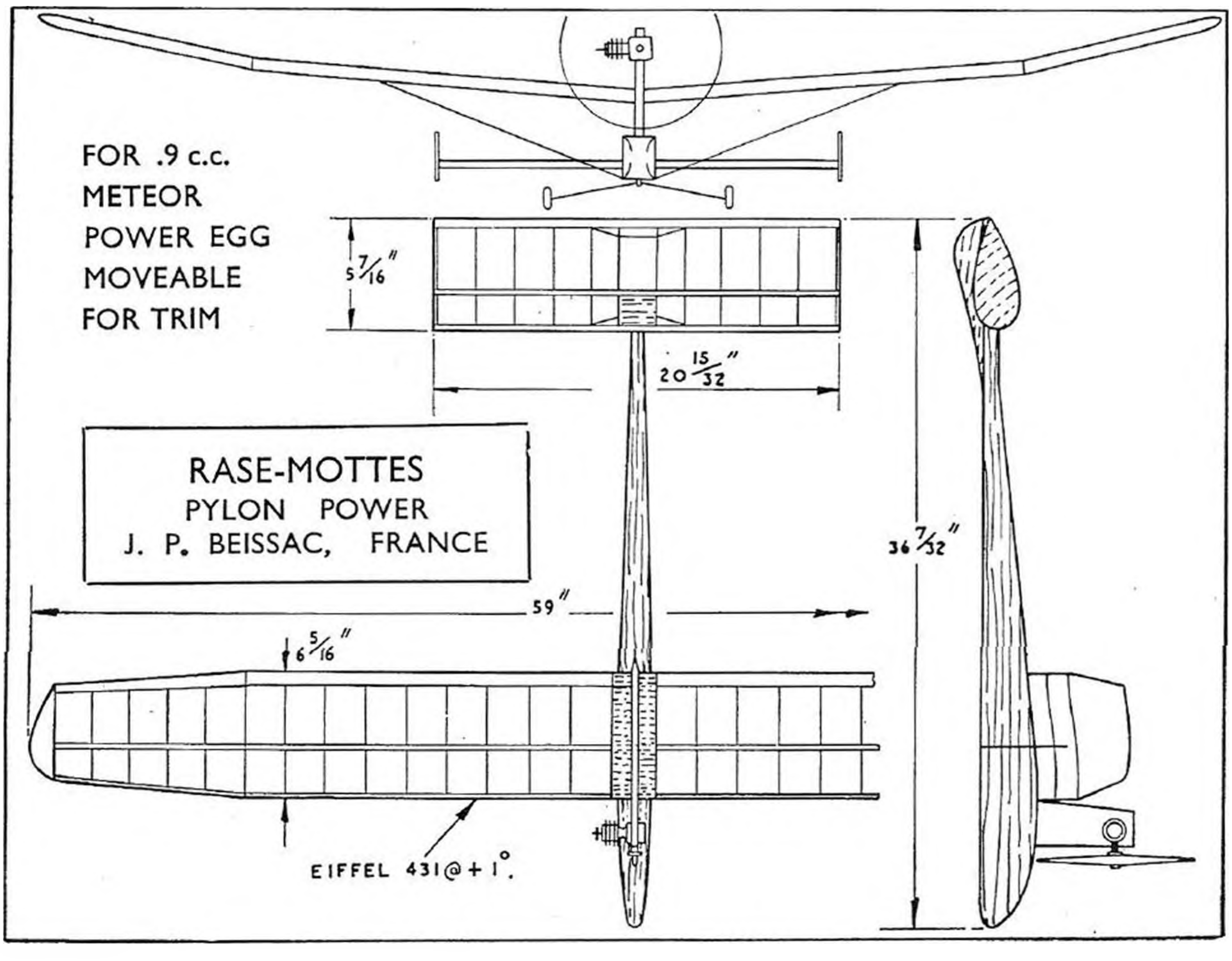

13 13/16"
DURAL BEARERS.
2 3/16"
3/8" PLYWOOD.
1/4 FULL SIZE.
1/8" DIA CANE.
14 S.W.G. WIRE.
3 3/8"
DURAL CLIP
14 S.W.G. WIRE.
WING 1/10 FULL SIZE.
11 3/8"
37 13/16"
SKETCH OF TONGUE RIBS.
WITHOUT U/C & ENGINE CAN BE FLOWN AS GLIDER
DUPLEX
TAILLESS PUSHER
By VL. PROCHAZKY
CZECHOSLOVAKIA
BIND.
SKETCH OF WING TIP.
30°
SKETCH OF C/S.
FOR 2.5 c.c. ENGINES
1/4" SQ SPRUCE
1/8" SQ SPRUCE.
WING SECTION HALF SIZE.
3/8" x 3/32" SPRUCE.
3/32" x 3/8" SPRUCE.

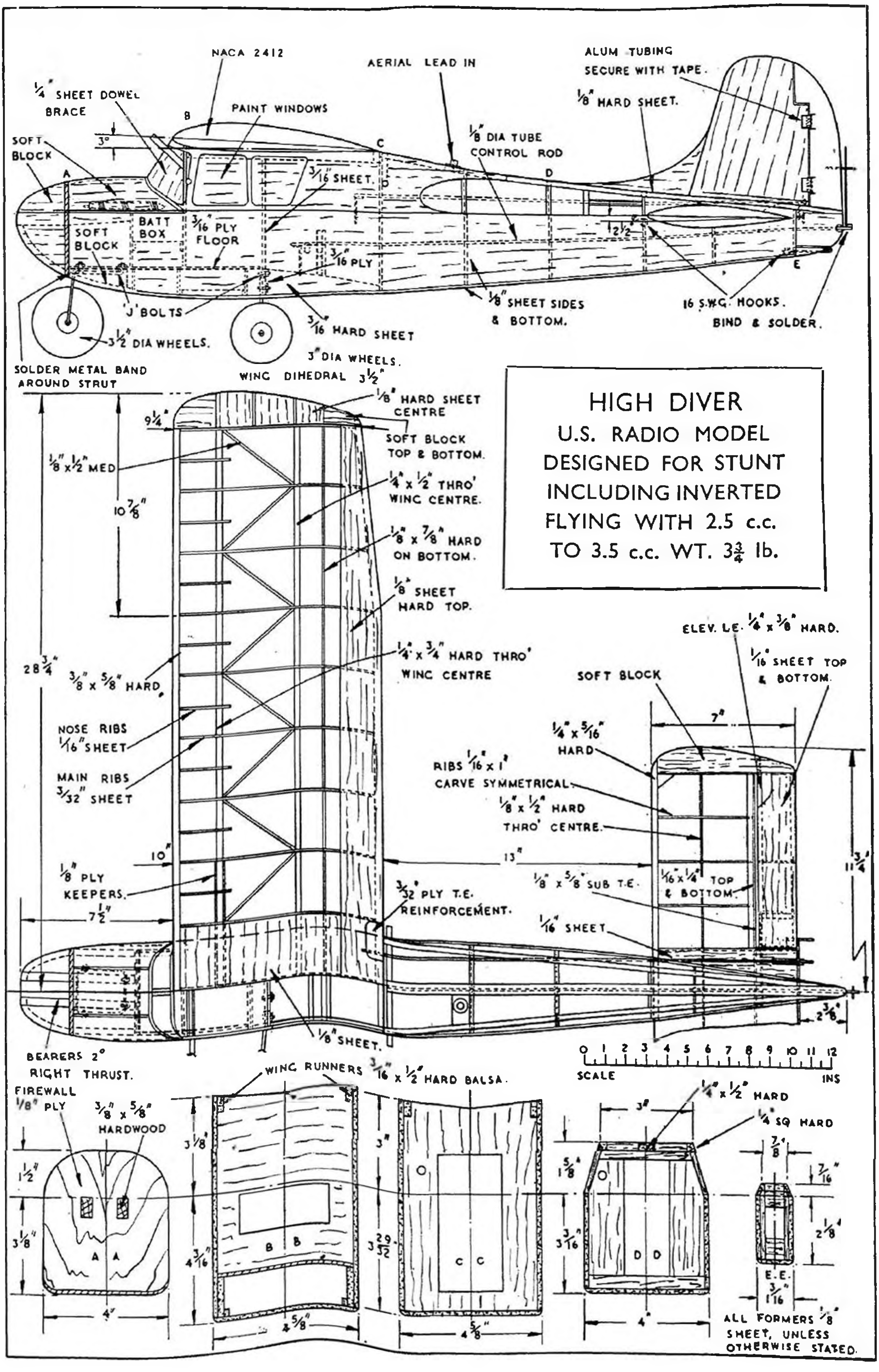

3/32" SHEET FORMERS.
HARDWOOD PLUG.
2 3/4"
7 1/2"
1 9/16"
3 25/32
16 17/32"
11 13/16"
1/16" PLY FORMERS
ALUMN. TUBE 9/16" O/D 1/2" I/D
3 9/16"
2 3/4"
2 3/4"
1 3/32"
3 15/16"
6 11/16"
1 3/16"
1/4"
1 3/16"
14 3/4"
7 3/32"
1 15/16"
3 1/4"
1/16" SHEET.
19 11/16"
17/32"
1/8" PLY SKID.
3 9/16"
21 5/8"
ALL WING & TAIL RIBS 1/16" SHEET.
7 15/32"
TOIO
A/2 COPPA ROSSI WINNER
DESIGNED By
A. GHIOTTO, ITALY
1/32" SHEET.
1/8" SQ.
1/8" x 3/16".
1/16" x 3/16".
1/8" x 3/8".
HALF SIZE TAIL SECTION.
1/4" x 3/16" BALSA L.E.
1/32" SHEET.
HALF SIZE WING SECTION.
3/16" x 1" BALSA T.E.
1/16" PLY FIRST 2 BAYS ONLY.
1/8" x 5/16" SPRUCE SPAR.
1/16" x 1/4" BALSA SPAR.

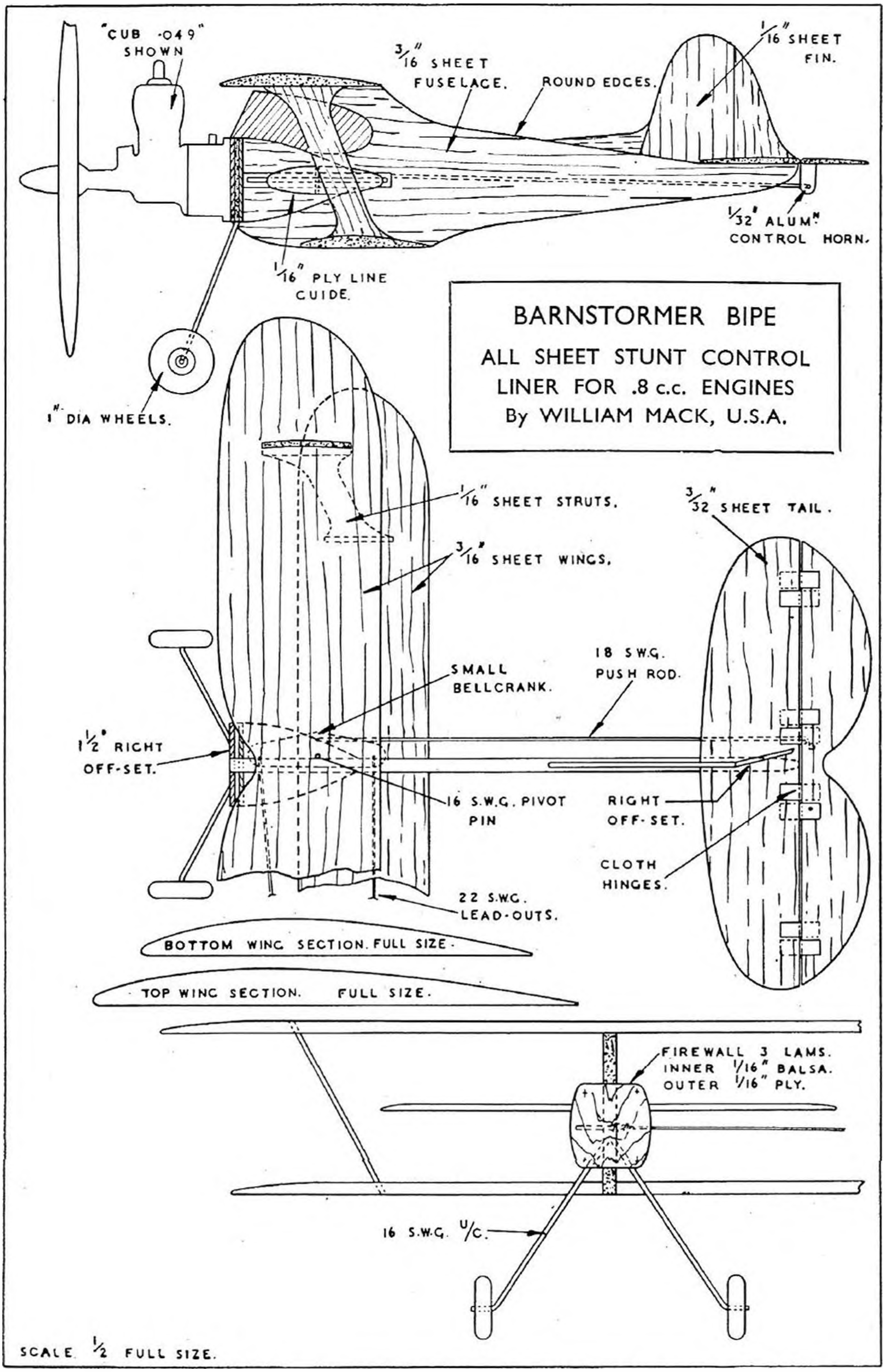

16¾"
TAILPLANE
CLARK Y 8-9%
3 15/16"
3 5/8"
1 3/8"
MAIN
PLANE
CLARK Y
—10%
22 5/8"
ML-1 POWER EGG PYLON
FOR 1-1.5 c.c.
W. ZBUDOV POLAND
5½"
33"
0 1 2 3 4 5
SCALE. INS.


CAN BE FLOWN AS
GLIDER WITHOUT
POWER EGG
0°
11"
14 3/4"
8°
6 7/8"
3 15/16"
STERUS-1
POWER-ASSISTED
R/C GLIDER
GROUP DESIGN, POLAND
1·66 c.c.
55 7/8"
11 13/16"
+2½°
WING SECTION
EIFFEL 400.
TAIL SECTION
NACA 009.
48 13/16"

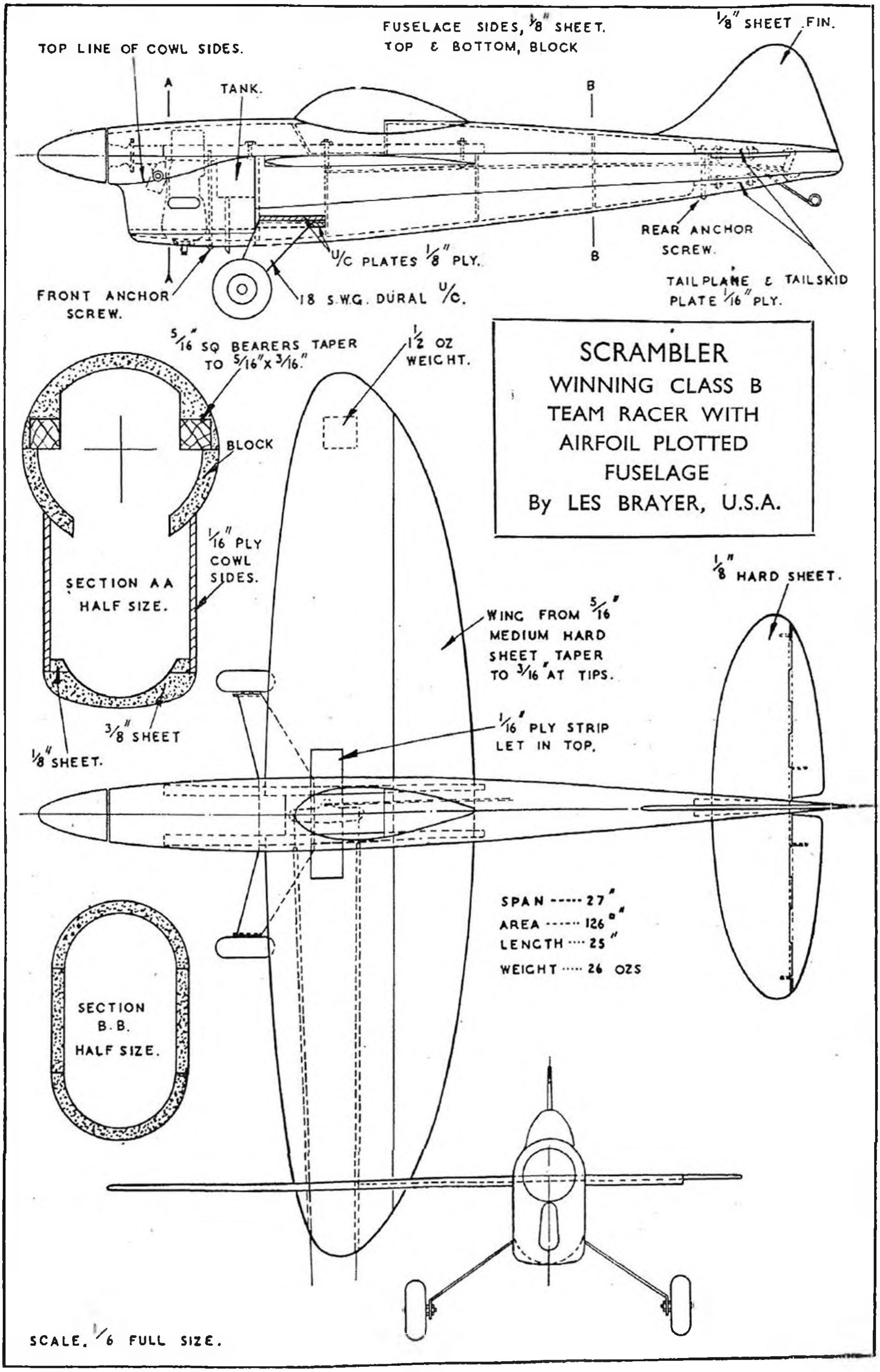

60 5/8"
27 3/4"
18°
5°
NOTE TURBULATOR
WIRES TO MAINPLANE
MAINPLANE NACA 6409
TAILPLANE CLARK Y
46 3/8"
PROFILE BULB
HIGH PERFORMANCE
SAILPLANE BY
A. TRZCINSKI, POLAND
TAILPLANE
HAS 5°
DIHEDRAL


FOR .9 c.c.
METEOR
POWER EGG
MOVEABLE
FOR TRIM
5 7/16"
20 15/32"
RASE-MOTTES
PYLON POWER
J. P. BEISSAC, FRANCE
36 7/32"
59"
6 5/16"
EIFFEL 431@+1°.

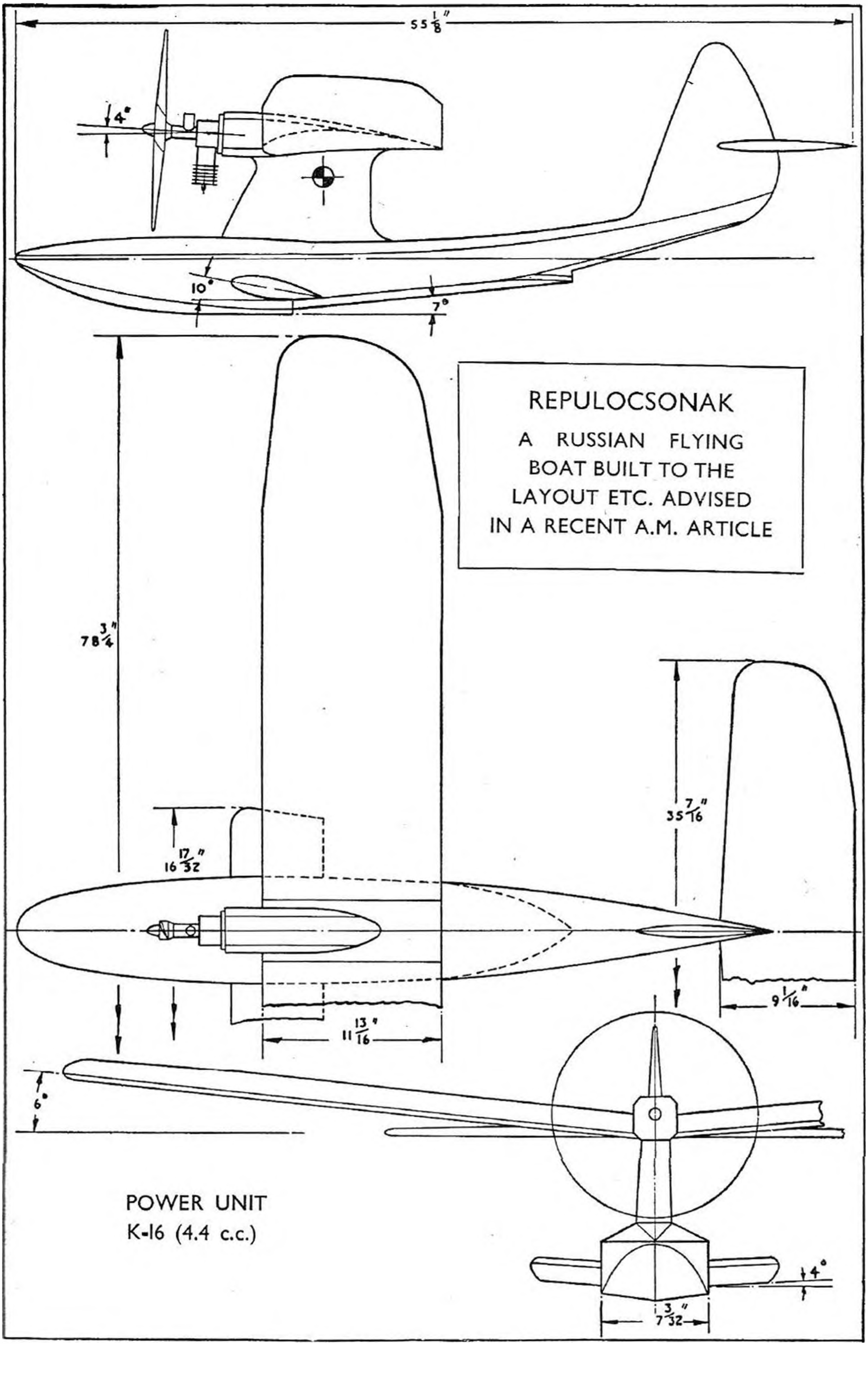

HIGH DIVER
U.S. RADIO MODEL
DESIGNED FOR STUNT
INCLUDING INVERTED
FLYING WITH 2.5 c.c.
TO 3.5 c.c. WT. 3¾ lb.
NACA 2412
AERIAL LEAD IN
ALUM TUBING SECURE WITH TAPE.
1/8" HARD SHEET.
1/4" SHEET DOWEL BRACE
PAINT WINDOWS
SOFT BLOCK
3/16" SHEET.
1/8" DIA TUBE CONTROL ROD
BATT BOX
3/16" PLY FLOOR
SOFT BLOCK
3/16" PLY
'J' BOLTS
1/8" SHEET SIDES & BOTTOM.
16 S.W.G. HOOKS. BIND & SOLDER.
3/16" HARD SHEET
3½" DIA WHEELS.
3" DIA WHEELS.
SOLDER METAL BAND AROUND STRUT
WING DIHEDRAL 3½"
1/8" HARD SHEET CENTRE
SOFT BLOCK TOP & BOTTOM.
1/8" x 1/2" MED
1/4" x 1/2" THRO' WING CENTRE.
1/8" x 7/8" HARD ON BOTTOM.
1/8" SHEET HARD TOP.
1/4" x 3/4" HARD THRO' WING CENTRE
3/8" x 5/8" HARD
NOSE RIBS 1/16" SHEET
MAIN RIBS 3/32" SHEET
1/8" PLY KEEPERS.
3/32" PLY T.E. REINFORCEMENT.
ELEV. L.E. 1/4" x 3/8" HARD.
1/16" SHEET TOP & BOTTOM.
SOFT BLOCK
1/4" x 5/16" HARD
RIBS 1/16" x 1" CARVE SYMMETRICAL
1/8" x 1/2" HARD THRO' CENTRE.
1/8" x 5/8" SUB T.E.
1/16" x 1/4" TOP & BOTTOM.
1/16" SHEET
1/8" SHEET.
BEARERS 2° RIGHT THRUST.
SCALE INS
WING RUNNERS 3/16" x 1/2" HARD BALSA.
FIREWALL 1/8" PLY
3/8" x 5/8" HARDWOOD
1/4" x 1/2" HARD
1/4" SQ HARD
ALL FORMERS 1/8" SHEET, UNLESS OTHERWISE STATED.

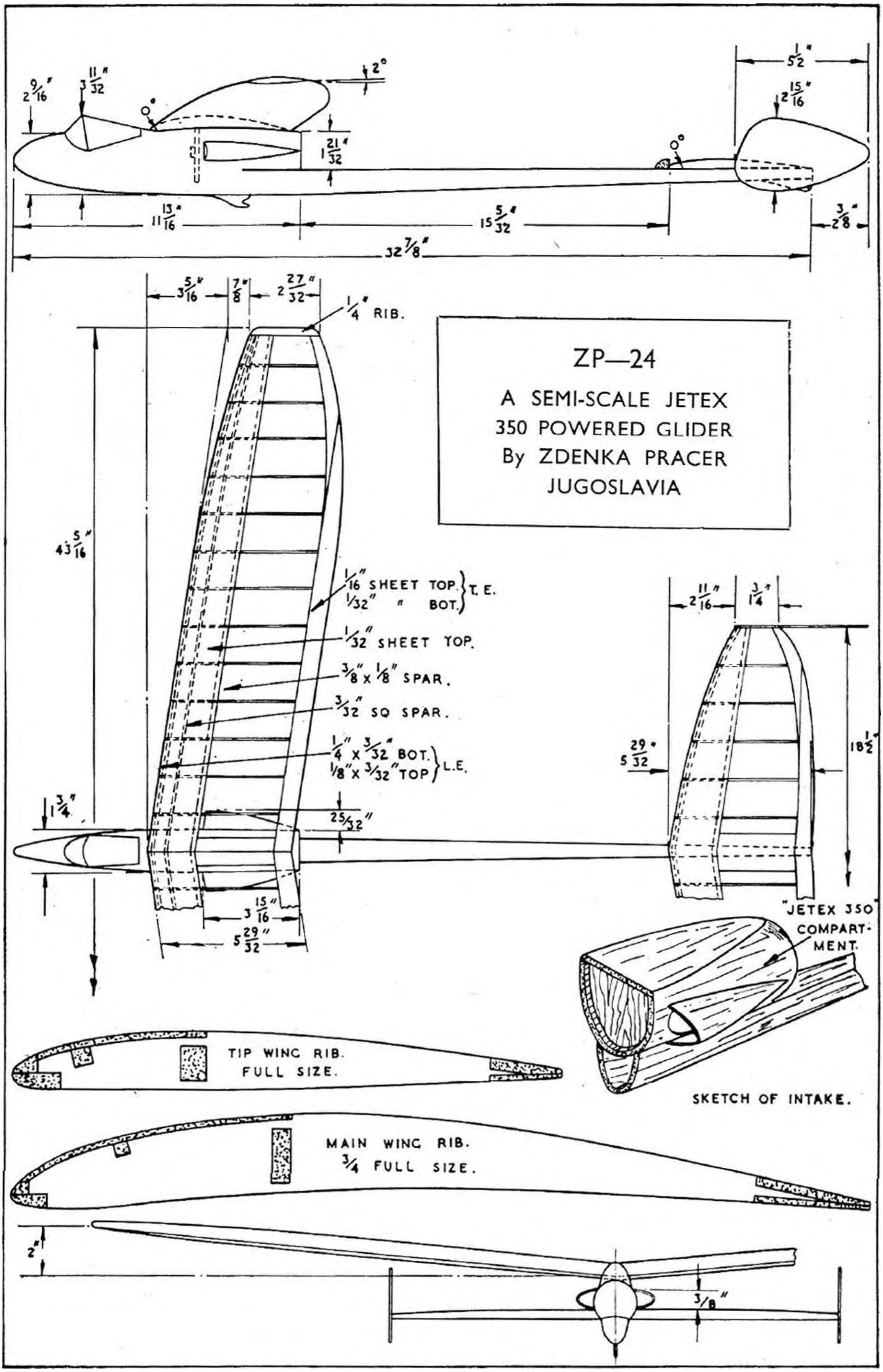


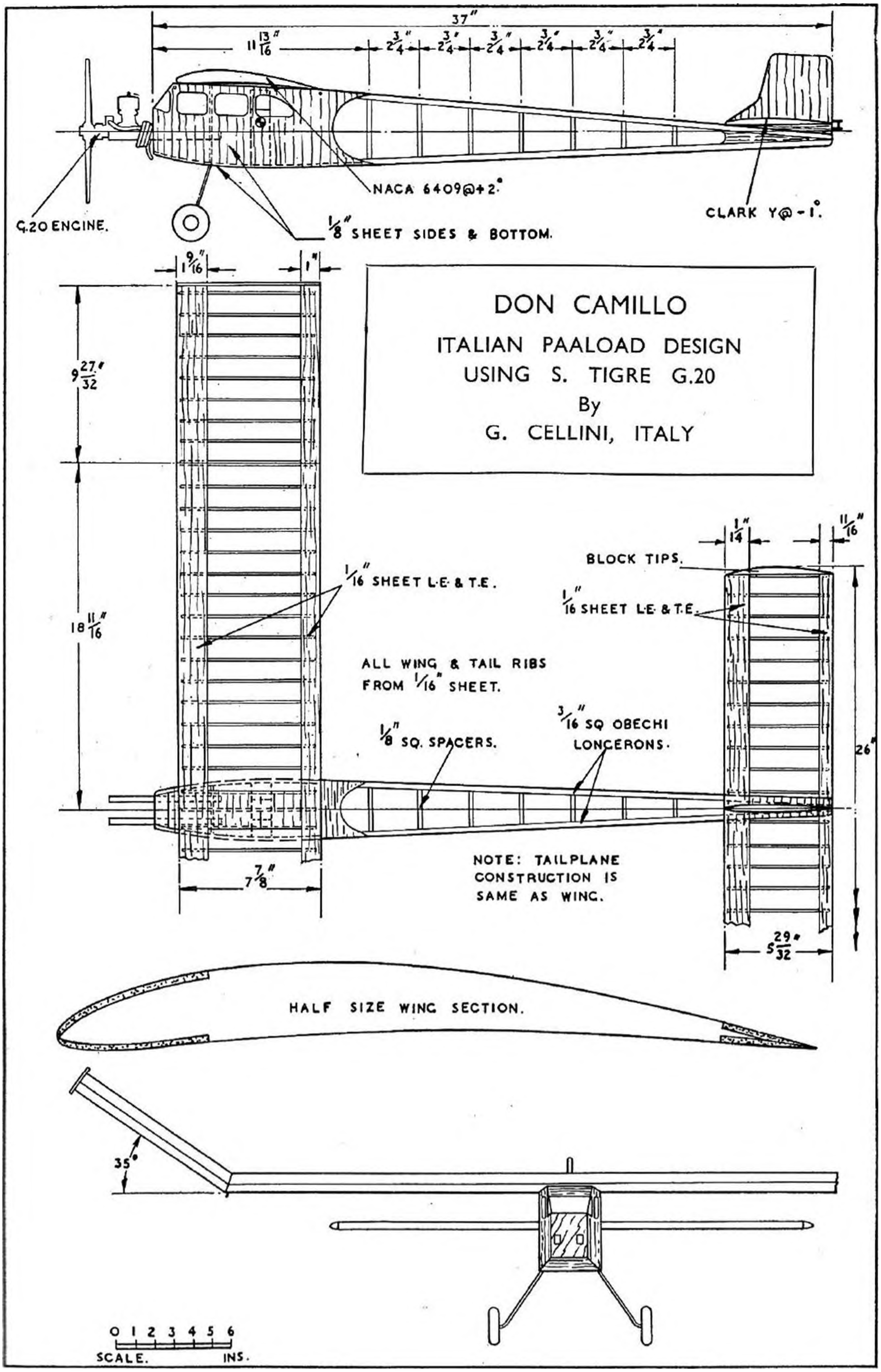
"CUB ·049" SHOWN
3/16" SHEET FUSELAGE.
ROUND EDGES.
1/16" SHEET FIN.
1/32" ALUM^N CONTROL HORN.
1/16" PLY LINE GUIDE.
BARNSTORMER BIPE
ALL SHEET STUNT CONTROL LINER FOR .8 c.c. ENGINES
By WILLIAM MACK, U.S.A.
1" DIA WHEELS.
1/16" SHEET STRUTS.
3/32" SHEET TAIL.
3/16" SHEET WINGS.
SMALL BELLCRANK.
18 S.W.G. PUSH ROD.
1 1/2" RIGHT OFF-SET.
16 S.W.G. PIVOT PIN
RIGHT OFF-SET.
CLOTH HINGES.
22 S.W.G. LEAD-OUTS.
BOTTOM WING SECTION. FULL SIZE.
TOP WING SECTION. FULL SIZE.
FIREWALL 3 LAMS. INNER 1/16" BALSA. OUTER 1/16" PLY.
16 S.W.G. U/C.
SCALE 1/2 FULL SIZE.

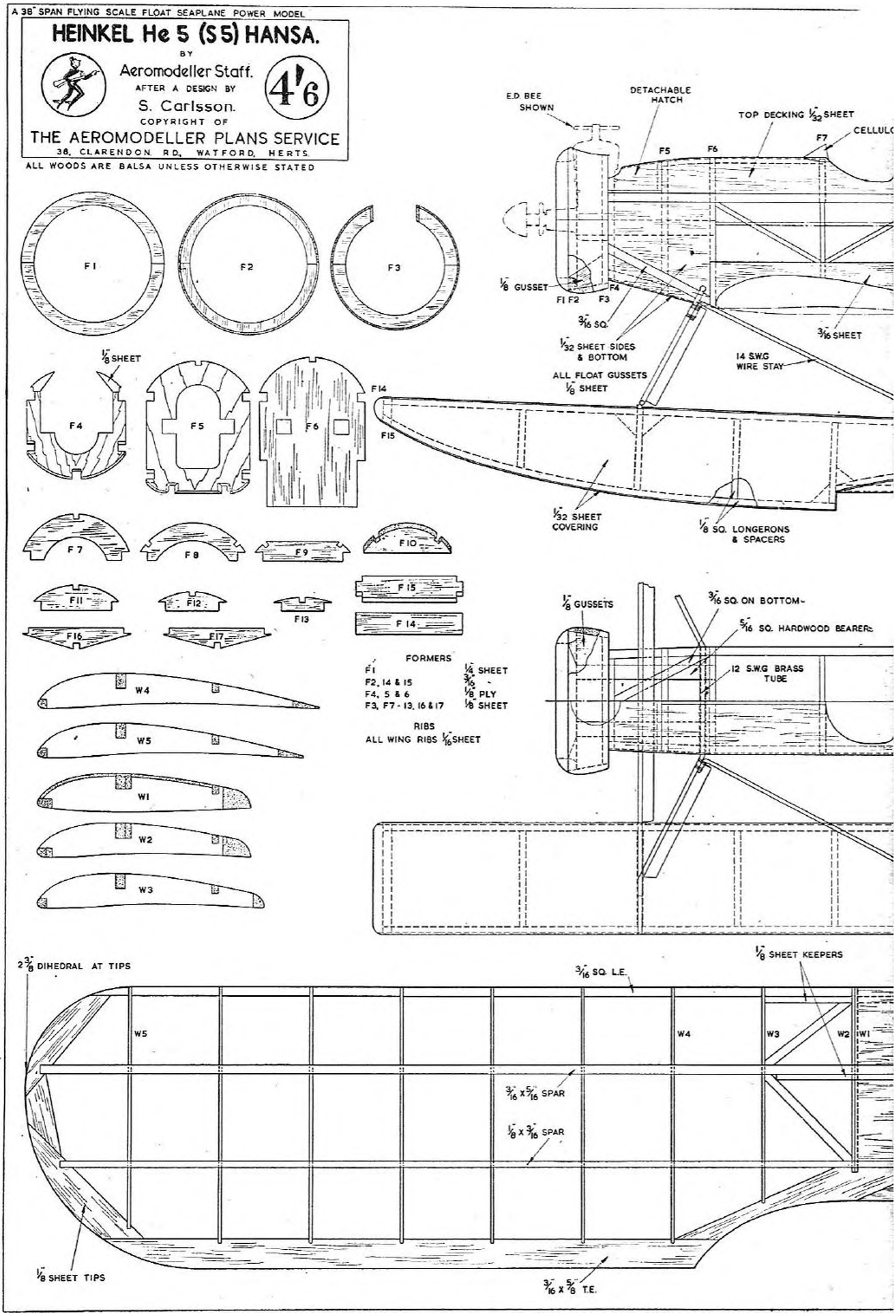


FUSELAGE SIDES, 1/8" SHEET.
TOP & BOTTOM, BLOCK
1/8" SHEET FIN.
TOP LINE OF COWL SIDES.
A
TANK.
B
REAR ANCHOR SCREW.
B
U/C PLATES 1/8" PLY.
FRONT ANCHOR SCREW.
18 S.W.G. DURAL U/C.
TAILPLANE & TAILSKID PLATE 1/16" PLY.
5/16" SQ BEARERS TAPER TO 5/16" x 3/16".
1 1/2 OZ WEIGHT.
SCRAMBLER
WINNING CLASS B
TEAM RACER WITH
AIRFOIL PLOTTED
FUSELAGE
By LES BRAYER, U.S.A.
BLOCK
1/16" PLY COWL SIDES.
SECTION AA
HALF SIZE.
1/8" HARD SHEET.
WING FROM 5/16" MEDIUM HARD SHEET, TAPER TO 3/16" AT TIPS.
3/8" SHEET
1/8" SHEET.
1/16" PLY STRIP LET IN TOP.
SPAN ----- 27"
AREA ------ 126 □"
LENGTH ···· 25"
WEIGHT ····· 26 OZS
SECTION
B.B.
HALF SIZE.
SCALE. 1/6 FULL SIZE.


55 1/8"
4°
10°
7°
REPULOCSONAK
A RUSSIAN FLYING BOAT BUILT TO THE LAYOUT ETC. ADVISED IN A RECENT A.M. ARTICLE
78 3/4"
35 7/16"
16 17/32"
11 13/16"
9 1/16"
6°
POWER UNIT
K-16 (4.4 c.c.)
4°
7 3/32"

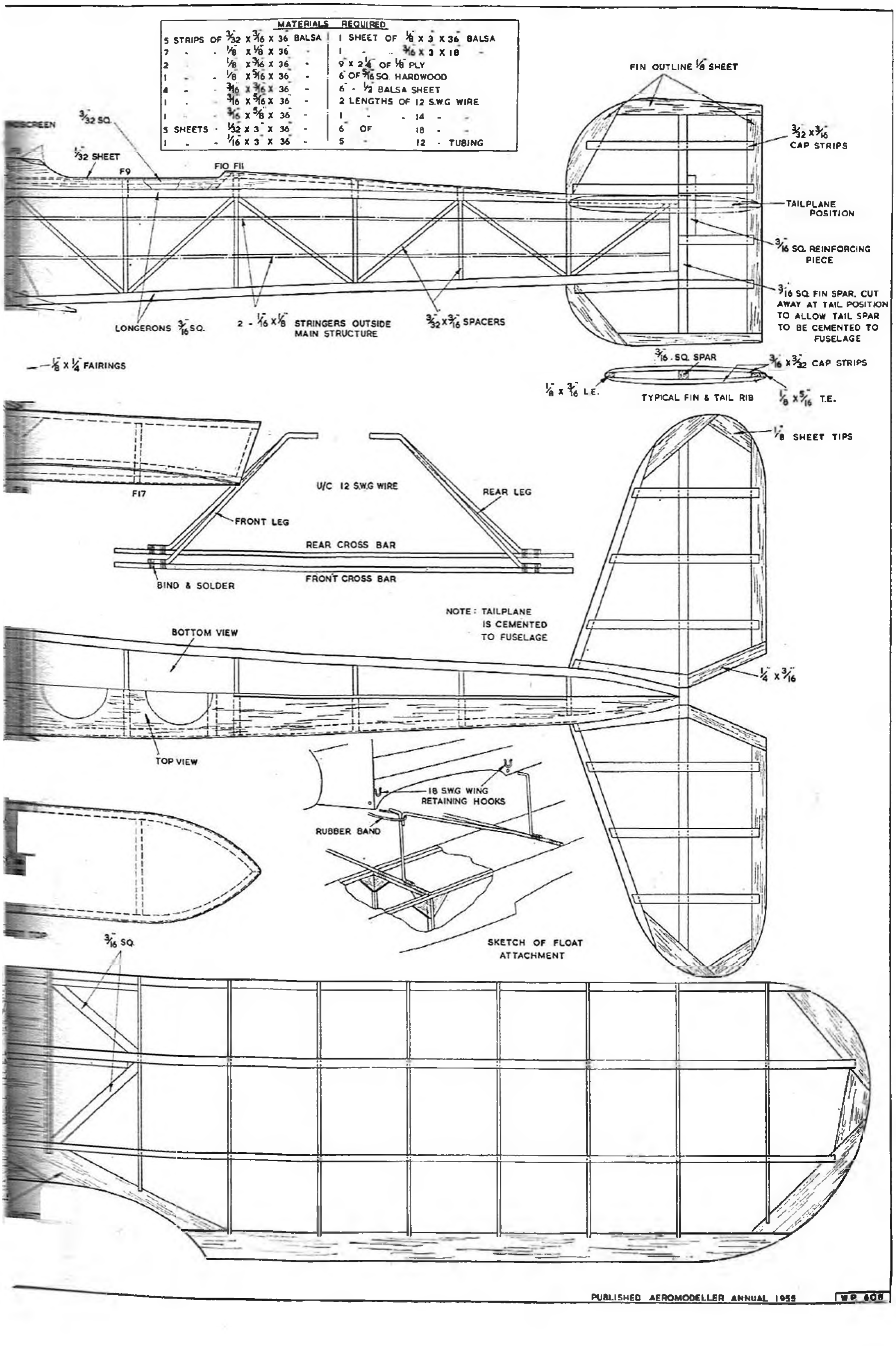

ZP—24
A SEMI-SCALE JETEX
350 POWERED GLIDER
By ZDENKA PRACER
JUGOSLAVIA
1/4" RIB.
1/16" SHEET TOP. 1/32" " BOT. T. E.
1/32" SHEET TOP.
3/8" x 1/8" SPAR.
3/32" SQ SPAR.
1/4" x 3/32" BOT. 1/8" x 3/32" TOP L.E.
"JETEX 350" COMPARTMENT.
SKETCH OF INTAKE.
TIP WING RIB. FULL SIZE.
MAIN WING RIB. 3/4 FULL SIZE.

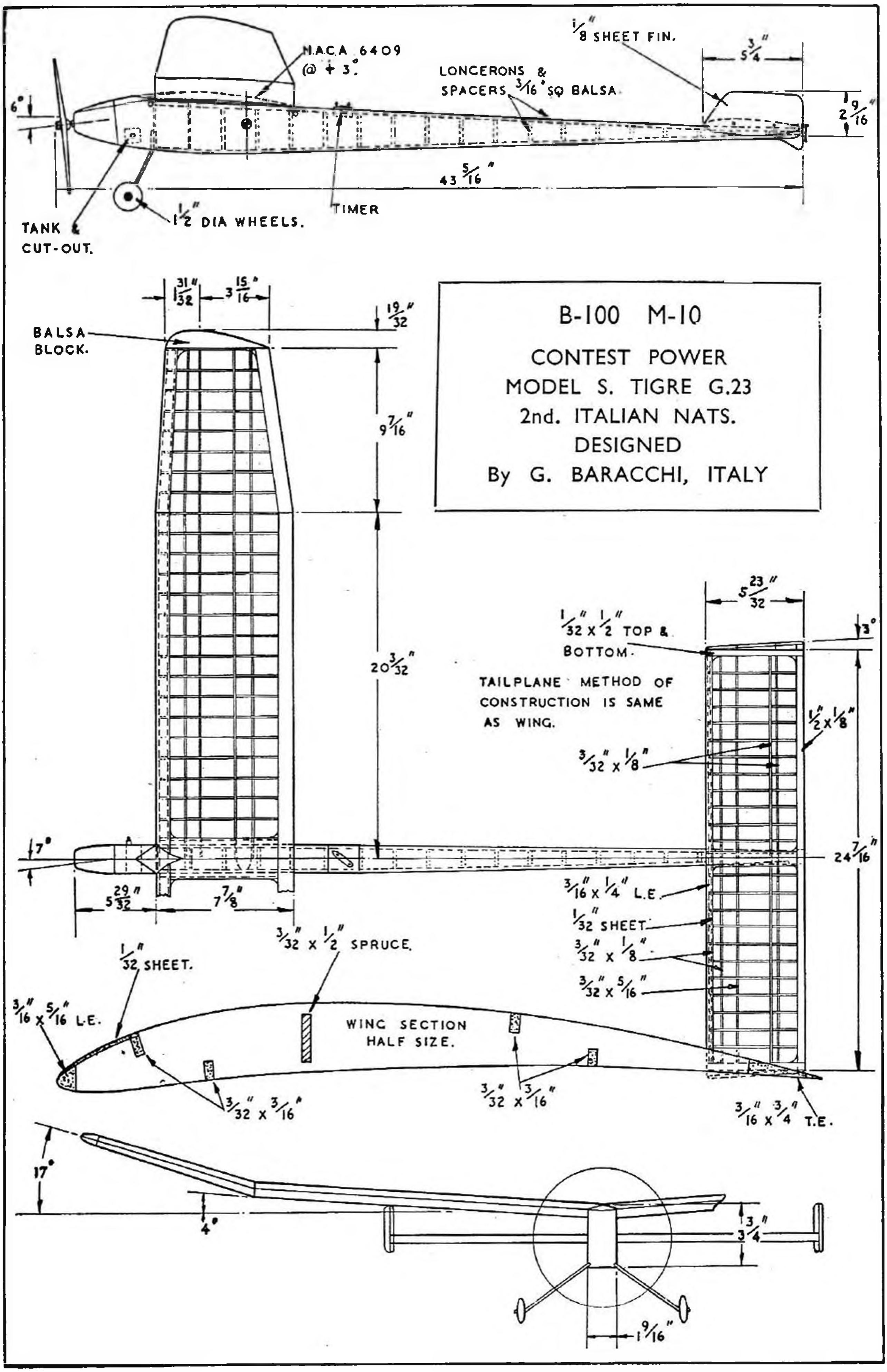

DON CAMILLO
ITALIAN PAALOAD DESIGN
USING S. TIGRE G.20
By
G. CELLINI, ITALY
37"
11 13/16"
2 3/4"
G.20 ENGINE.
NACA 6409@+2°
1/8" SHEET SIDES & BOTTOM.
CLARK Y@-1°
1 9/16"
1"
9 27/32"
18 11/16"
1/16" SHEET L.E. & T.E.
ALL WING & TAIL RIBS FROM 1/16" SHEET.
1/8" SQ. SPACERS.
3/16" SQ OBECHI LONGERONS.
BLOCK TIPS.
1 1/4"
11/16"
26"
7 7/8"
NOTE: TAILPLANE CONSTRUCTION IS SAME AS WING.
5 29/32"
HALF SIZE WING SECTION.
35°
0 1 2 3 4 5 6
SCALE. INS.

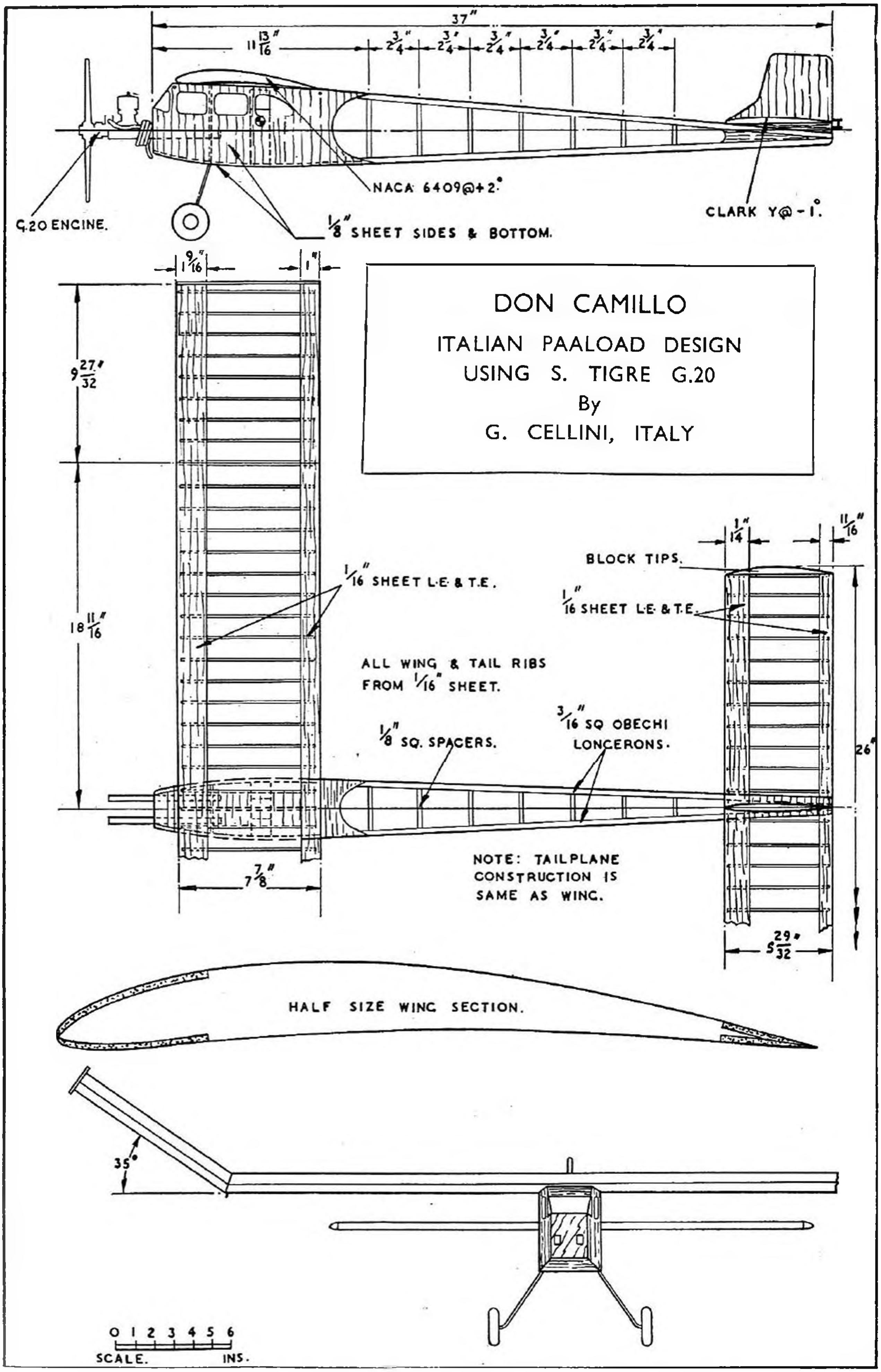

A 38" SPAN FLYING SCALE FLOAT SEAPLANE POWER MODEL
HEINKEL He 5 (S 5) HANSA.
BY
Aeromodeller Staff.
AFTER A DESIGN BY
S. Carlsson.
COPYRIGHT OF
THE AEROMODELLER PLANS SERVICE
38, CLARENDON RD., WATFORD, HERTS.
4/6
ALL WOODS ARE BALSA UNLESS OTHERWISE STATED
F1
F2
F3
1/8 SHEET
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F17
FORMERS
F1 1/4 SHEET
F2, 14 & 15 3/16 "
F4, 5 & 6 1/8 PLY
F3, F7 - 13, 16 & 17 1/8 SHEET
RIBS
ALL WING RIBS 1/16 SHEET
W4
W5
W1
W2
W3
E.D. BEE SHOWN
DETACHABLE HATCH
TOP DECKING 1/32 SHEET
1/8 GUSSET
F1 F2 F3
3/16 SQ.
1/32 SHEET SIDES & BOTTOM
ALL FLOAT GUSSETS 1/8 SHEET
3/16 SHEET
14 S.W.G WIRE STAY
1/32 SHEET COVERING
1/8 SQ. LONGERONS & SPACERS
1/8 GUSSETS
3/16 SQ. ON BOTTOM
5/16 SQ. HARDWOOD BEARER
12 S.W.G BRASS TUBE
2 3/8 DIHEDRAL AT TIPS
3/16 SQ. L.E.
1/8 SHEET KEEPERS
3/16 x 5/16 SPAR
1/8 x 3/16 SPAR
1/8 SHEET TIPS
3/16 x 5/8 T.E.

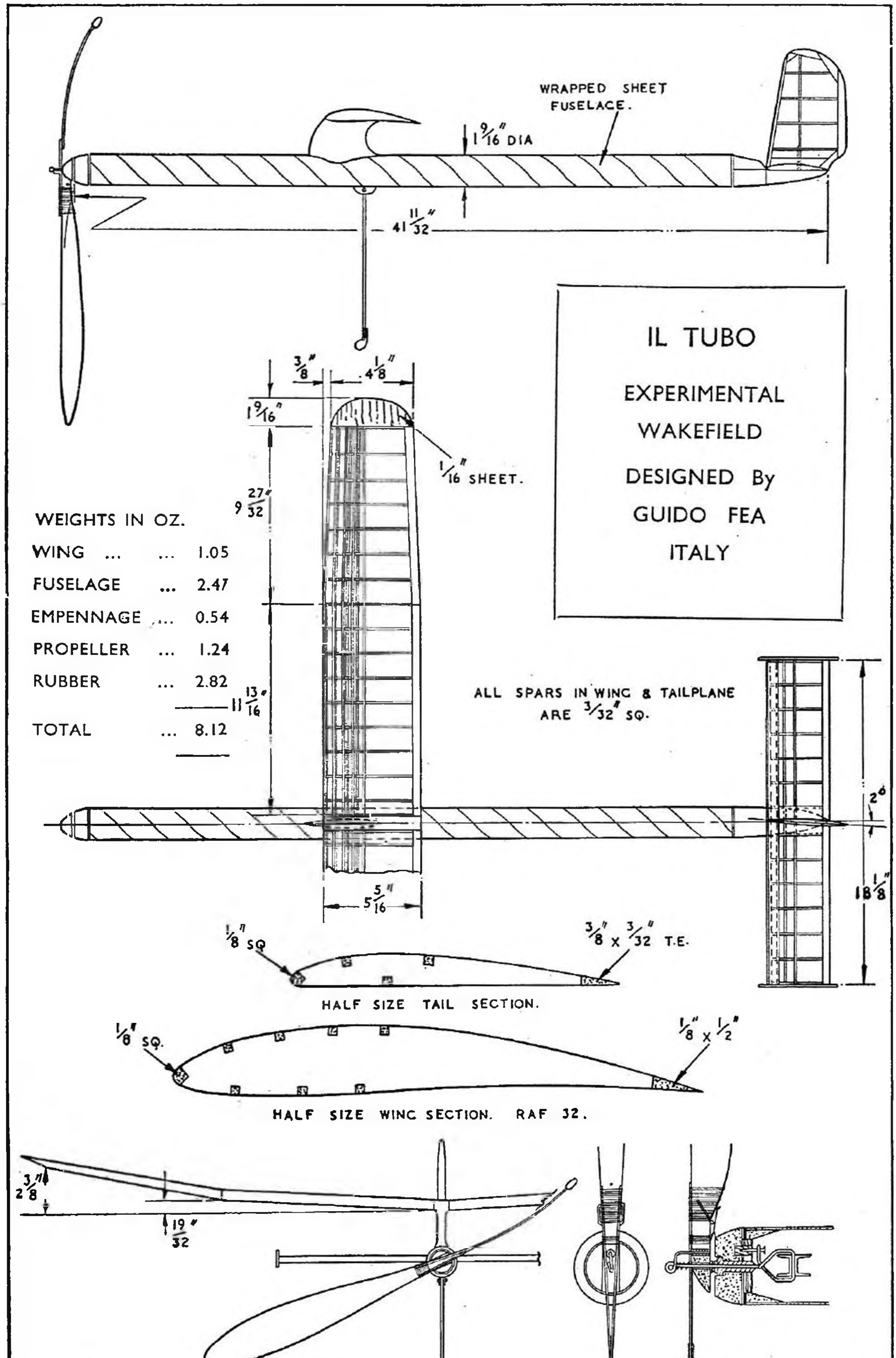
MATERIALS REQUIRED

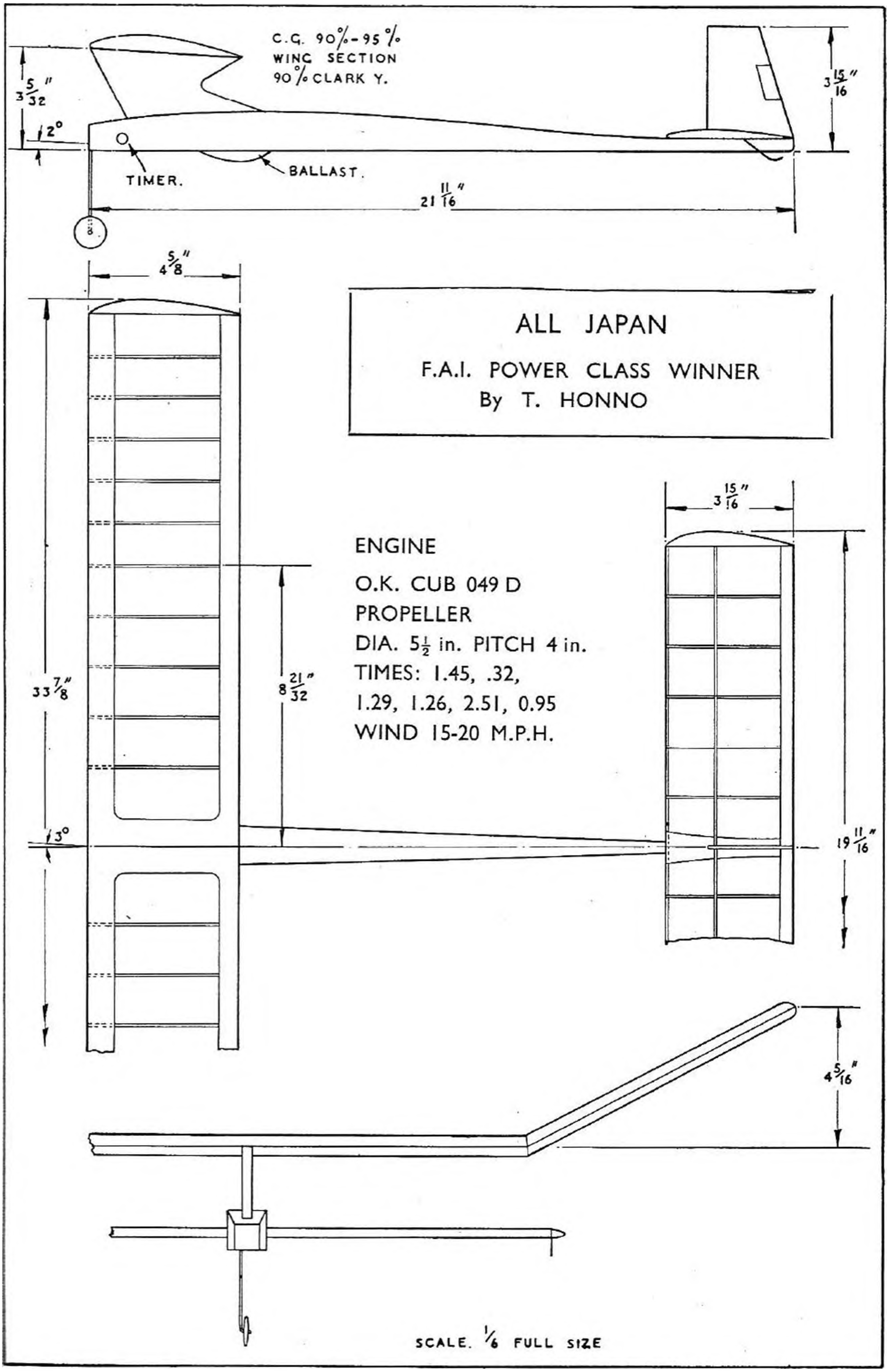
5 STRIPS OF 3/32" X 3/16" X 36" BALSA	1 SHEET OF 1/8" X 3" X 36" BALSA
7 - - 1/8" X 1/8" X 36" -	1 - - 3/16" X 3" X 18" -
2 1/8" X 3/16" X 36" -	9" X 2 1/4" OF 1/8" PLY
1 - - 1/8" X 5/16" X 36" -	6" OF 5/16" SQ. HARDWOOD
4 - - 3/16" X 3/16" X 36" -	6" - 1/2" BALSA SHEET
1 - - 3/16" X 5/16" X 36" -	2 LENGTHS OF 12 S.W.G WIRE
1 - - 3/16" X 5/8" X 36" -	1 - - 14 - -
5 SHEETS - 1/32" X 3" X 36" -	6 OF 18 - -
1 - - 1/16" X 3" X 36" -	5 - 12 - TUBING

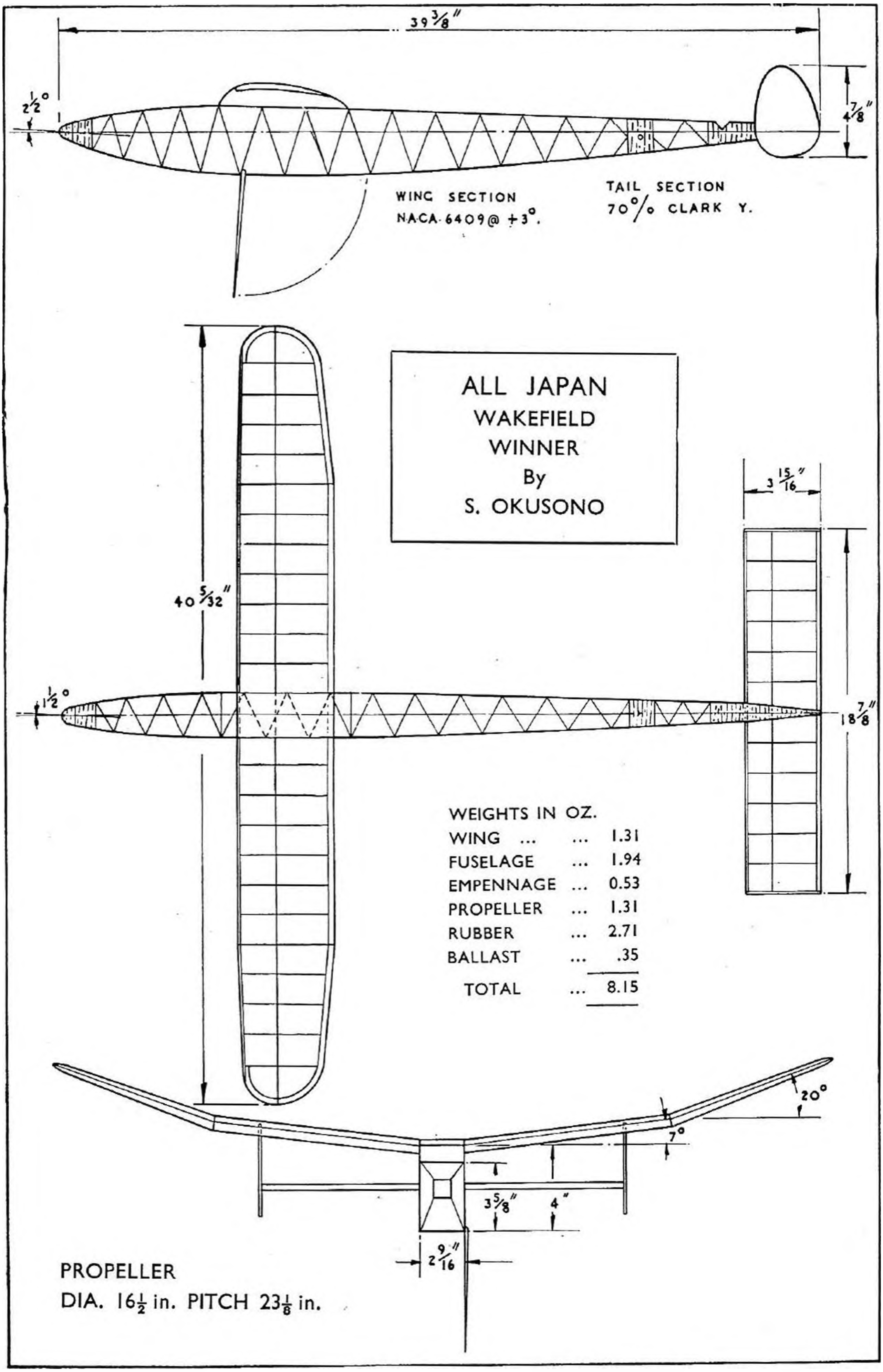


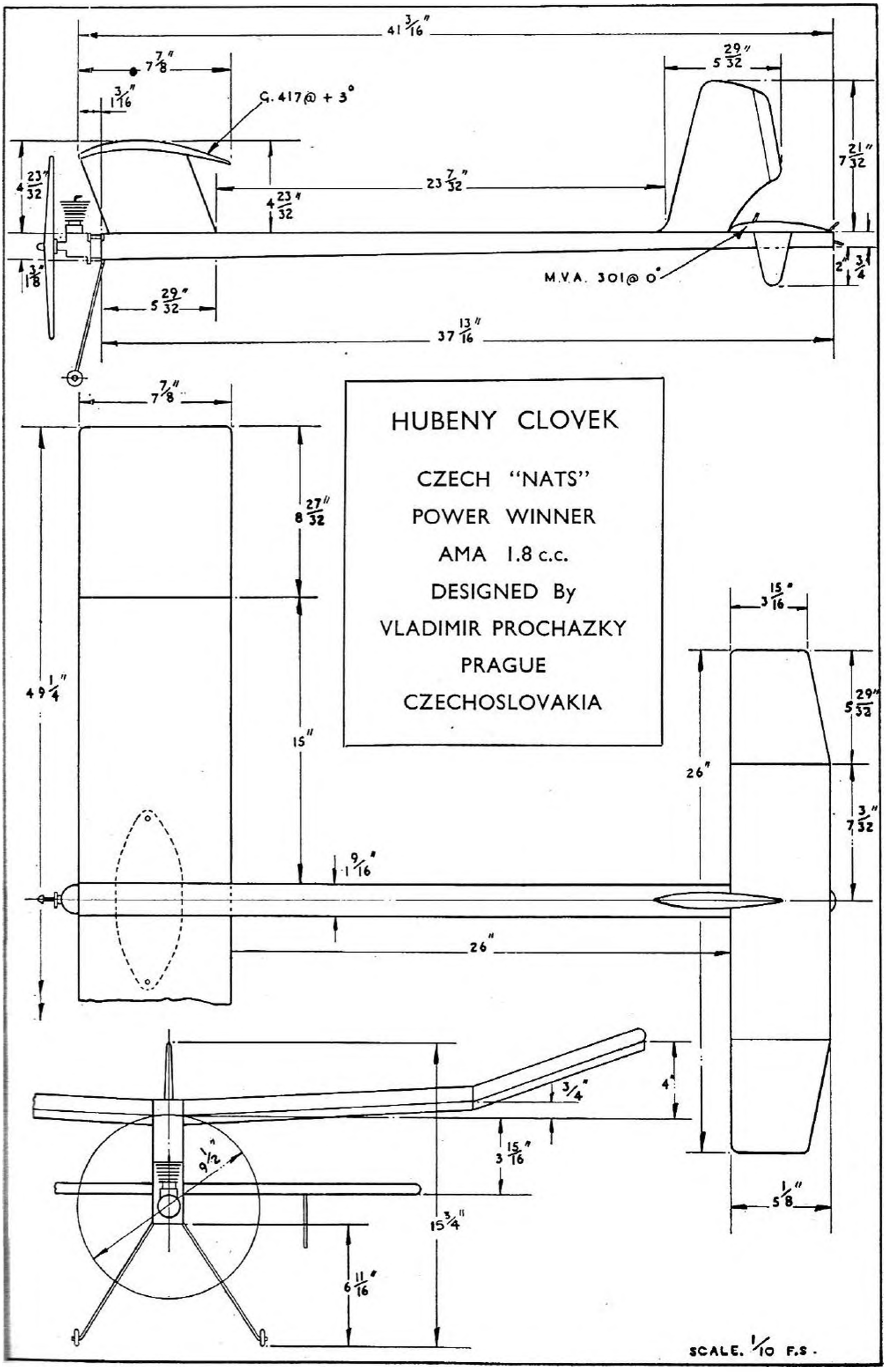

B-100 M-10
CONTEST POWER
MODEL S. TIGRE G.23
2nd. ITALIAN NATS.
DESIGNED
By G. BARACCHI, ITALY
N.A.C.A 6409
@ + 3°
1/8" SHEET FIN.
LONGERONS & SPACERS 3/16" SQ BALSA
5 3/4"
2 9/16"
6°
43 5/16"
TANK & CUT-OUT.
1 1/2" DIA WHEELS.
TIMER
BALSA BLOCK.
1 31/32"
3 15/16"
19/32"
9 7/16"
20 3/32"
7°
5 29/32"
7 7/8"
5 23/32"
1/32" x 1/2" TOP & BOTTOM.
3°
TAILPLANE METHOD OF CONSTRUCTION IS SAME AS WING.
1/2" x 1/8"
3/32" x 1/8"
24 7/16"
3/16" x 1/4" L.E.
1/32" SHEET
3/32" x 1/8"
3/32" x 5/16"
3/32" x 1/2" SPRUCE.
1/32" SHEET.
3/16" x 5/16" L.E.
WING SECTION HALF SIZE.
3/32" x 3/16"
3/32" x 3/16"
3/16" x 3/4" T.E.
17°
4°
3 3/4"
1 9/16"

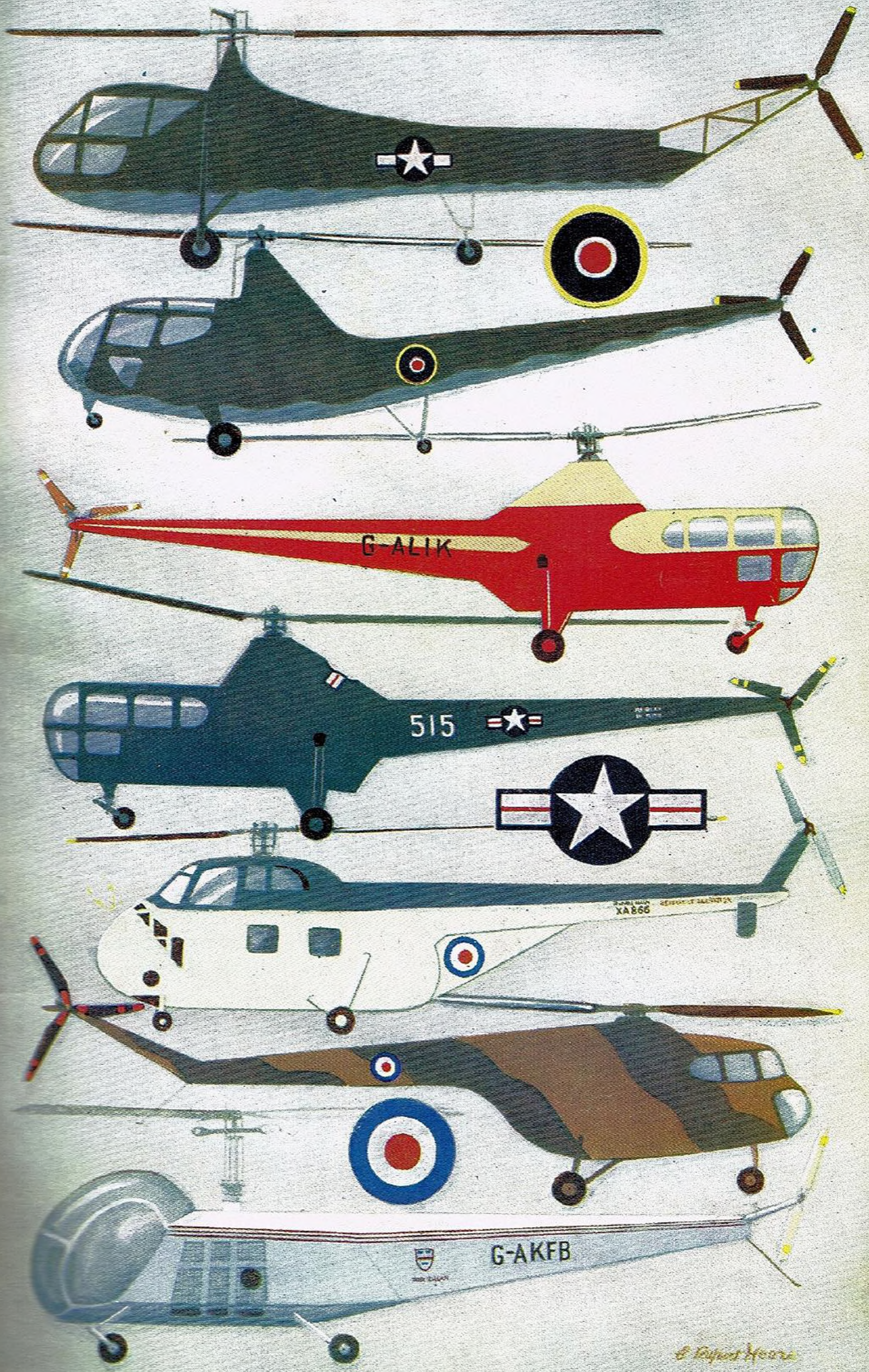

37"
11 13/16"
2 3/4"
2 3/4"
2 3/4"
2 3/4"
2 3/4"
2 3/4"
G.20 ENGINE.
NACA 6409@+2°
CLARK Y@-1°.
1/8" SHEET SIDES & BOTTOM.
1 9/16"
1"
DON CAMILLO
ITALIAN PAALOAD DESIGN
USING S. TIGRE G.20
By
G. CELLINI, ITALY
9 27/32"
18 11/16"
1/4"
11/16"
BLOCK TIPS.
1/16" SHEET L.E. & T.E.
1/16" SHEET L.E. & T.E.
ALL WING & TAIL RIBS
FROM 1/16" SHEET.
1/8" SQ. SPACERS.
3/16" SQ OBECHI
LONGERONS.
26"
NOTE: TAILPLANE
CONSTRUCTION IS
SAME AS WING.
7 7/8"
5 29/32"
HALF SIZE WING SECTION.
35°
0 1 2 3 4 5 6
SCALE. INS.


WRAPPED SHEET FUSELACE.
1 9/16" DIA
41 11/32"
IL TUBO
EXPERIMENTAL WAKEFIELD
DESIGNED By GUIDO FEA ITALY
3/8"
4 1/8"
1 9/16"
1/16" SHEET.
9 27/32"
WEIGHTS IN OZ.
WING 1.05
FUSELAGE ... 2.47
EMPENNAGE ... 0.54
PROPELLER ... 1.24
RUBBER ... 2.82
11 13/16
TOTAL ... 8.12
ALL SPARS IN WING & TAILPLANE ARE 3/32" SQ.
2°
18 1/8"
5 5/16"
1/8" SQ
3/8" x 3/32" T.E.
HALF SIZE TAIL SECTION.
1/8" SQ.
1/8" x 1/2"
HALF SIZE WINC SECTION. RAF 32.
2 3/8"
19/32"


C.G. 90%-95%
WING SECTION
90% CLARK Y.
3 5/32"
2°
3 15/16"
TIMER.
BALLAST.
21 11/16"
4 5/8"
ALL JAPAN
F.A.I. POWER CLASS WINNER
By T. HONNO
3 15/16"
ENGINE
O.K. CUB 049 D
PROPELLER
DIA. 5½ in. PITCH 4 in.
TIMES: 1.45, .32,
1.29, 1.26, 2.51, 0.95
WIND 15-20 M.P.H.
33 7/8"
8 21/32"
3°
19 11/16"
4 5/16"
SCALE. 1/6 FULL SIZE


39 3/8"
2½°
4 7/8"
WING SECTION
NACA 6409 @ +3°.
TAIL SECTION
70% CLARK Y.
ALL JAPAN
WAKEFIELD
WINNER
By
S. OKUSONO
3 15/16"
40 5/32"
1½°
18 7/8"
WEIGHTS IN OZ.
WING 1.31
FUSELAGE ... 1.94
EMPENNAGE ... 0.53
PROPELLER ... 1.31
RUBBER ... 2.71
BALLAST ... .35
TOTAL ... 8.15
20°
7°
3 5/8"
4"
2 9/16"
PROPELLER
DIA. 16½ in. PITCH 23⅛ in.


HUBENY CLOVEK
CZECH "NATS"
POWER WINNER
AMA 1.8 c.c.
DESIGNED By
VLADIMIR PROCHAZKY
PRAGUE
CZECHOSLOVAKIA
G. 417 @ + 3°
M.V.A. 301 @ 0°
41 3/16"
7 7/8"
1 3/16"
5 29/32"
4 23/32"
23 7/32"
7 21/32"
1 3/8"
2 3/4"
37 13/16"
8 27/32"
15"
49 1/4"
1 9/16"
26"
3 15/16"
7 3/32"
4"
3/4"
9 1/2"
15 3/4"
6 11/16"
5 1/8"
SCALE. 1/10 F.S.


G-ALIK
515
G-AKFB

SOME ROTORS SEEN IN BRITAIN

By C. Rupert Moore, A.R.C.A.

The subject of the frontispiece is the British European Airways helicopter G-AJSR coming in to land on the Festival site on the South Bank of the Thames on Monday, July 28th, 1952.

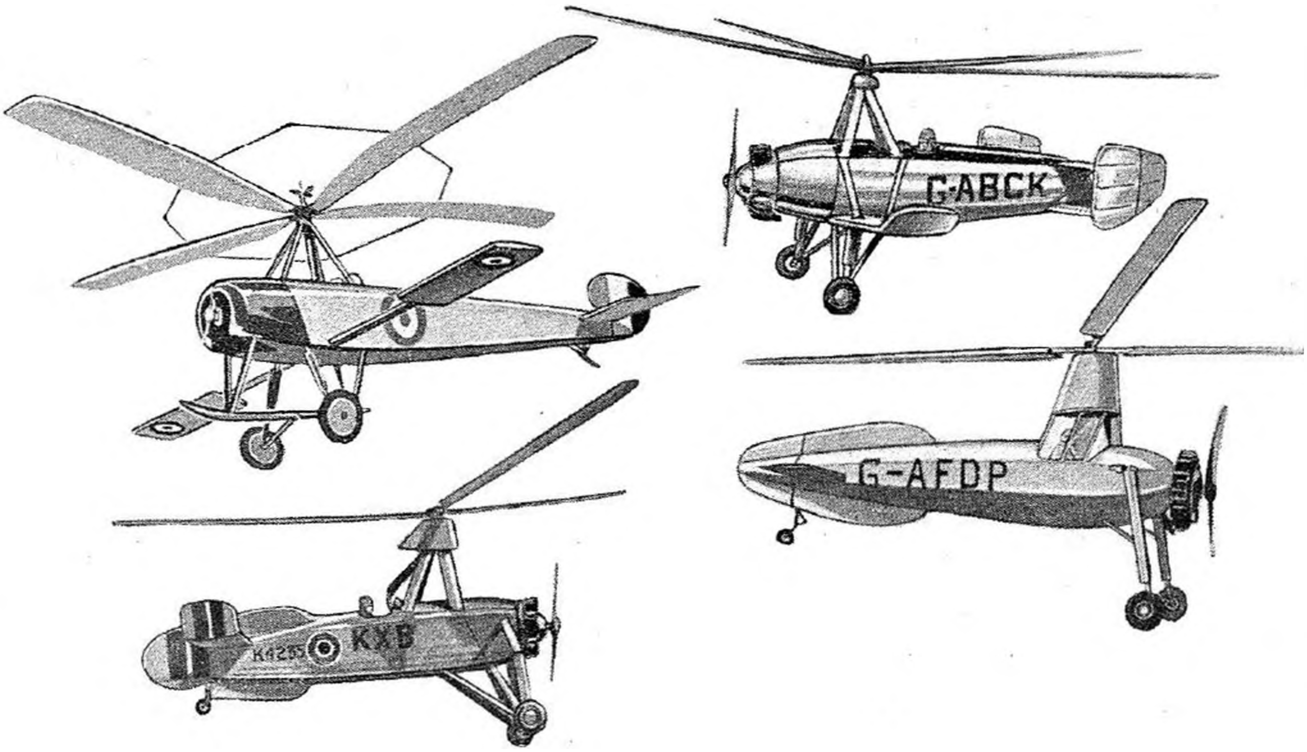
On that day, G-AJOR made the first trial flight to find out if the site were safe. Orders were to fly low over the Debating Chamber of the Houses of Parliament to test noise level.

The choice of the Sikorski S51 for the place of honour, was not difficult, as this type has an unsurpassed list of achievements. Here are a few of them: June, 1947, the London to Paris City centre to centre speed record, this was made possible by the cutting out of surface transport to and from London Airport and Le Bourget. During the disastrous floods when the North Sea broke the sea defences of both East Anglia and Holland in February, 1953, thirty-nine helicopters, mostly S51's, carried the brunt of the rescue work. In Holland nine helicopters of 705 Squadron Royal Navy, rescued over half the total, some 810 persons. Two pilots each in a single day rescued 147 and 110 people respectively!

The Wolf Rock Lighthouse was relieved by S51.

The only survivor from the Goodwin Lightship was saved by S51. During the Korean war the helicopter saved the lives of 25,000 wounded.

When B.E.A. decided to set up an experimental Helicopter Unit in July, 1947, they bought three S.51's and two Bell 47 trainers from the United States (G-AKFB colour plate). The G.P.O. were quick to avail themselves of this unit, and the first helicopter Air Mail Service was inaugurated on June 1st, 1948 based at Peterborough. Several weeks of dummy runs were made before actual services began. Simultaneously, night runs were being made and during the winter of 1949-50 the Night Mail to Peterborough and Norwich was run with remarkable regularity. Passenger flights began in June, 1950, between Liverpool and Cardiff. In June, 1951, the London-Birmingham Passenger service began, making two intermediate stops a Northolt and Elmdon. This was run by the three S51's, G-AJOR G-AJOV, and G-AKCU, and it was in 'JOR on this route that I made my first helicopter flight. What an experience this was, after taking off vertically we proceeded sideways before turning on to our course. The landing area at London Airport was a large white circle enclosing an H painted on the tarmac. Coming in to land, we overshot this mark by a couple of yards, so we calmly reined backwards dropping with our rear wheels exactly on the legs of the "H", and our nose wheel on the perimeter of the circle! The decided nosedown attitude in level forward flight was a little disconcerting to one used to fixed wing aircraft. Another new feature was the rhythmatical beat as the rotor blades passed over the tail boom, giving a pleasant feeling of flapping wings, in fact, I felt quite in sympathy with a crowd of crows not so far below over Hayes church tower. After several months, this service was discontinued, sufficient experience having been gained.



July, 1955, saw the inauguration of the helicopter service from the Festival site. Westland S55's being used.

My introduction to rotating wing aircraft, apart from seeing the first AVRO CIERVA at the R.A.F. Display at Hendon in 1927, was by the inventor Don Juan de la Cierva himself. This happened at the Aero Exhibition at Olympia in 1928, where I had gone to make sketches. He explained the whole works to me. He said the autogiro was the stepping stone to the helicopter, demonstrating that by using suitable blade sections at suitable angles, auto rotation was automatic by air forces alone, giving effective parachute effect, also that such a rotor when held edgeways to the air stream would rotate as before. Surprisingly enough, this was the correct way round to give lift and not backwards. Given sufficient foward speed the rotor would give climbing flight. It was these two features which made his pioneer flights in Madrid in 1922 possible. There was one major stability problem to be overcome, and that was the tendency of a rotor to turn on its back when pulled edgeways through the air by the airsrcew on the nose, for the rotor of an autogiro is turned solely by the air stream. The advancing blade of the rotor (i.e., the one travelling from tail to nose) is travelling faster through the air than the retreating one. This is because the whole aircraft is going forwards. The blades when on the "advancing" side give more lift than when on the "retreating" side. To overcome this overturning tendency, Cierva simply hinged the blades to the hub in such a way that when on the "advancing" side they rose, and when on the "retreating" side they could fall, giving a sort of automatic dihedral which equalised the lift on both sides, also the setting of the hinge angle was devised to reduce pitch on the advancing blade and increase pitch on the retreating one. In 1923 Cierva was invited by the Air Ministry to come to London.

The top left-hand illustration above, shows the early AVRO, built, Cierva autogiro which was simply an AVRO 504 fuselage with a rotor. Normal aeroplane controls were retained, including outrigged ailerons. The colour was aluminium fabric with shiny black cowling and R.A.F. insignia of the period. Until 1930 rudder stripes were Ultramarine, (leading) White and Vermilion.

G-ABCK is a Cierva C19 Mk3 of 1930, with "deflecting tail" for starting rotor. The top tail plane is hinged upwards to deflect the slipstream upwards onto the rotor tips.

In the earlier models, a rope was wound round the rotor spindle and several men got hold of it and ran like blazes, even then a long take off was necessary.

The colour of G-ABCK was aluminium and black. The third down is a Cierva C30 of 1935 vintage. This type is a great advance on the earlier marks. All control being attained by tilting the rotor axis by means of the angular stick seen between the rear pylon legs. A clutch mechanism was arranged to start the rotor turning.

Normally C30's were two seaters, but I chose the one illustrated because of historical interest.

K4235 was used by 526 Squadron R.A.F. for calibrating radar. It is camouflaged DARK GREEN and DARK EARTH on flanks and top with Sky below. Roundels are 1942 type, Indian red, narrow white and indigo outlined yellow. Fin flashes are same colours (red leading).

Squadron and individual letters KX-B are grey and serial K4235 is black—This machine survived the war.

G-AFDP is a Cierva C40 of 1939. This aircraft is a side by side two seater cabin jump start. The clutch mechanism was further developed to drive the rotor and act momentarily as a helicopter. The hinging of the blades was so arranged that they held an angle of no left until the drive was de-clutched, when they "overtook" the hub and swung into coarse pitch, giving a jump of some thirty feet.

The colour of G-AFDP was aluminium with black letters.

Shortly before Hitler's war, Cierva was killed in a crash at Croydon in an ordinary aeroplane. Dr. Bennett carried on the design and the C40 was produced under his direction, as were the helicopters W9, the two W11's, 3-rotor "Air Horse" and finally the Skeeter were produced after the war, but before going on to helicopters, here are a few notes on Autogiro registrations and colour.

CIERVA C18 G-ABGB—Aluminium, Vermilion letters.

CIERVA C19 Mk.3—G-AAYP, Aluminium, black letters.

G-ABCK, G-ABGB, G-ABUC, G-ABUH, G-ABUF, either Aluminium and black or aluminium and ultramarine letters.

CIERVA C30's—G-ACUU, ultramarine, aluminium letters—G-ACIO and G-ACFI, ultramarine, aluminium letters and flash.

G-AHTZ, Cream, black letters blue flash. G-ABXP, black and all letters.

G-ACKA, ultramarine, pale blue letters.

The R.A.F.'s C30's were in standard colours of the period, aluminium all over with vermilion, white and ultramarine roundels and black serial number. K4230 had a large 15 in black just forward of the roundel. No rudder markings.

CIERVA C40's jump start cabin model.

L.7589—R.A.F., colours as above.

G-AFDP, aluminium, black letters.

For most of the above, registrations and a good deal of the helicopter fact, I have to thank Francis Boreham, Esq., A.F.R.Ae.S., who has grown up with giros and helicopters. Before joining Westlands as A.I.D., he was with Cierva's and he let me go through his very impressive flying Log Book. He, of course, is well-known in the aeromodelling world. Now for helicopters. The first really practical helicopter was built by IGOR SIKORSKI in 1939, though a number of experimenters had obtained a large measure of success before this. The first helicopter to lift a pilot in tethered flight was built by BREGUET in 1908. The FOCKE ACHGELIS was the first fully controllable machine built in Germany with two side by side rotors. In 1939 SIKORSKI used the single lifting rotor with the vertically set anti-torque rotor at the tail. This rotor, not only stopped the fuselage rotating in opposition to the main rotor but, as the pitch was controllable by means of foot pedals, it acted as a rudder as well. On Sikorski's first successful machine, the VS300, two horizontally placed similar small rotors at the tail acted as elevators, but they are not now used. Vertical flight is achieved by increasing the pitch of the blades equally and collectively, and is known as the COLLECTIVE PITCH CONTROL. This in conjunction with the throttle gives up and down control. Without power the rotor is set to auto rotate as an ordinary autogiro. Also as the 'giro, the rotor blades are hinged at the root for flapping to correct the tendency to turn over in forward flight. Horizontal flight is achieved by tilting the effective axis of the rotor slightly in the direction of desired flight. This is done by causing the angle of the blades to vary as they travel round their circular flight path.

For forward flight the blade assumes the greatest incidence, when directly above and in line with the tail boom and least when straight ahead. When the blades pass the points at right angles to fore and aft line, they are halfway between these two extreme angles. This is called CYCLIC PITCH CONTROL and is used in conjunction with the COLLECTIVE PITCH AND THROTTLE.

The first helicopters to be seen in this country were American Army Air Force Sikorski XR4's, shown at the top of the coloured plate.

SIKORSKI XR4, 180 H.P. Warner radial engine—2-seater, in regulation U.S.A.A.F. colour of 1944 which is—OLIVE DRAB top and flanks; NEUTRAL GREY below. Main rotor—matt black; Tail rotor—matt black with cadmium yellow tips.

ROYAL AIR FORCE XR4's—were exactly the same, except for 1942 type roundels painted very far aft and shown enlarged just below the position. The roundel colour is not as now in use, but INDIAN RED, narrow WHITE and INDIGO outlined with TRAINER (CADMIUM) YELLOW. Large WHITE (3 ft. high) individual letters were carried just aft of undercarriage and 6 in. high ones on the flat front. Letters seen were B, D and E.

SIKORSKI XR6 "HOVERFLY II" (second one down), 245 h.p. Franklin, 2-seater. The colours are as above with the black serial number KM678. At the R.A.F. Display of 1950, one R.A.F. "Hoverfly" was KM837, the roundel, however, was the post-war pattern as shown below the "Bristol Sycamore" lower down and is vermilion, white and ultramarine. SIKORSKI S51 G-ALIK (third from top), is the fourth Westland built S51, the others n order are G-AKTW, G-ALEG, G-ALEI. The engine is the Alvis Leonides 540 h.p. Westlands secured the manufacturing rights of S51 and S55 soon after the war, and by 1949 had the largest helicopter factory in Europe. G-ALIK is glossy vermilion and cream with black registration letters. Rotor is aluminium above, and anti-dazzle black below. Tail rotor is mahogany with yellow and white tips. *U.S. NAVY* Sikorski S51—(fourth down) 450 h.p. Pratt and Whitney Wasp Junior in 1950 post-war scheme. This colour is MIDNIGHT BLUE (like a very dark P.R.U. blue). The current international insignia, which now has the vermilion line added and is shown enlarged below, is used. Rotors are either MIDNIGHT BLUE or OLIVE DRAB, above and anti-dazzle black below, tail rotor—midnight blue with yellow tip and band. White 515 on fuselage.

ROYAL NAVY Westland Sikorski S55. Top surfaces DARK SEA GREY, flanks and belly SKY. Serial number XA865, with words ROYAL NAVY above in black—rotors aluminium dope above, anti-dazzle black below, yellow tips. TAIL ROTOR—aluminium, yellow tips. Also S51 in same scheme, but with large serial number at root of tail boom GJ705 in front of roundel.

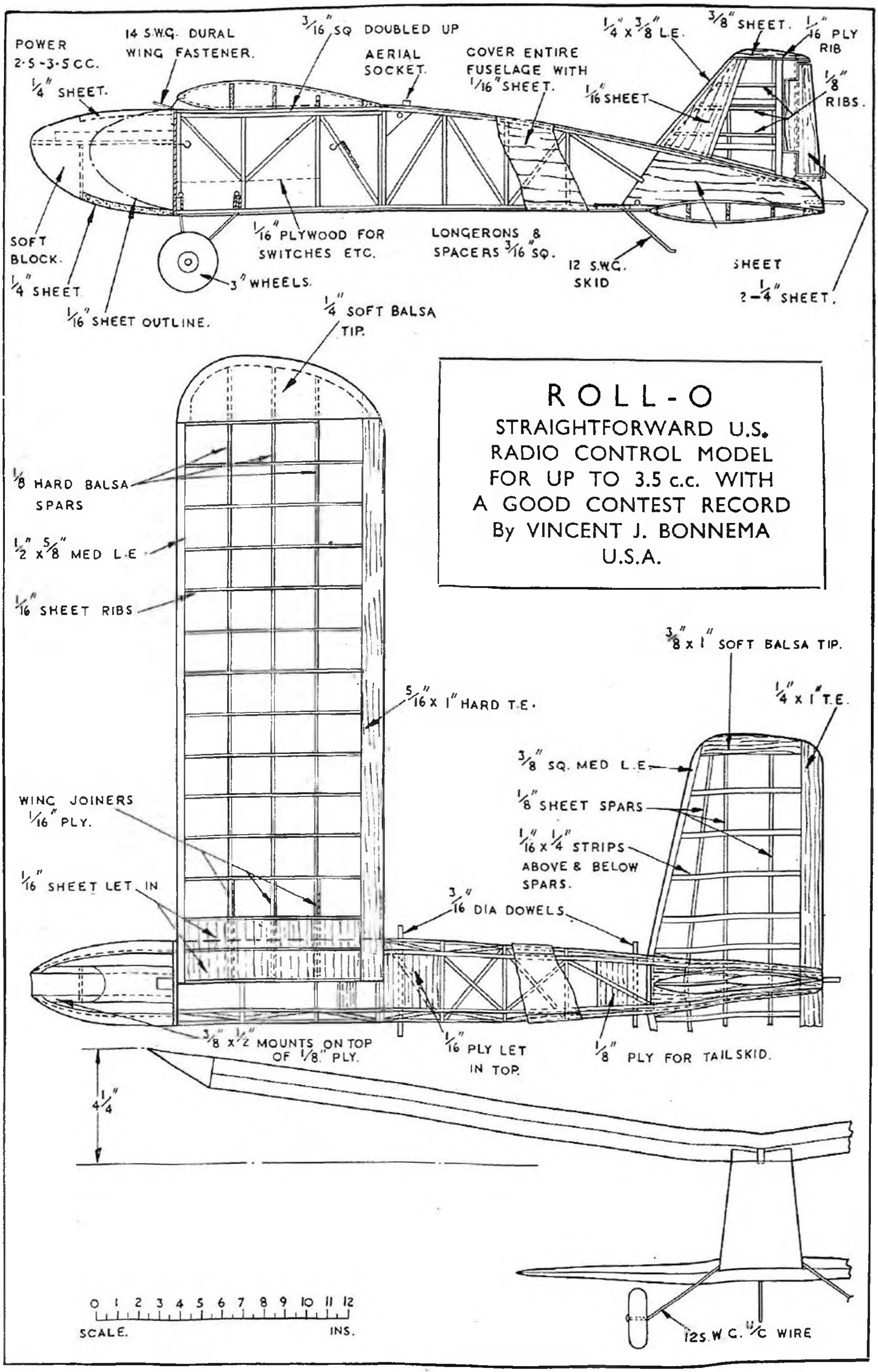
Saunders Roe SKEETERS were aluminium all over with roundel and serial. Example WF113. So also are some S51's used for rescue work.

ARMY OBSERVATION POST (A.O.P.) Bristol SYCAMORE, 540 h.p. Alvis Leonides. These aircraft follow the general scheme in force for Austers and are glossy DARK GREEN and DARK EARTH all over. The rotor is aluminium above and black below. TAIL ROTOR is aluminium with yellow tips. This is shown next to the bottom of the coloured illustration.

BRITISH EUROPEAN AIRWAYS—the frontispiece, shows the general scheme in current use and is used in modified form on all types. The Bristol Sycamore G-AMHW BRISTOL 173 twin rotor G-AMJI and S55's, G-ANWC, G-ANUK, G-ANFH are similar, a Union Jack is painted on the fin. This scheme is—ALUMINIUM, rotor, rotor pylon, drive channel along the spine of the tail boom, underbelly and undercarriage. WHITE fuselage sides. MAROON flashes and registration letters. The tail rotor is polished mahogany with yellow tips.

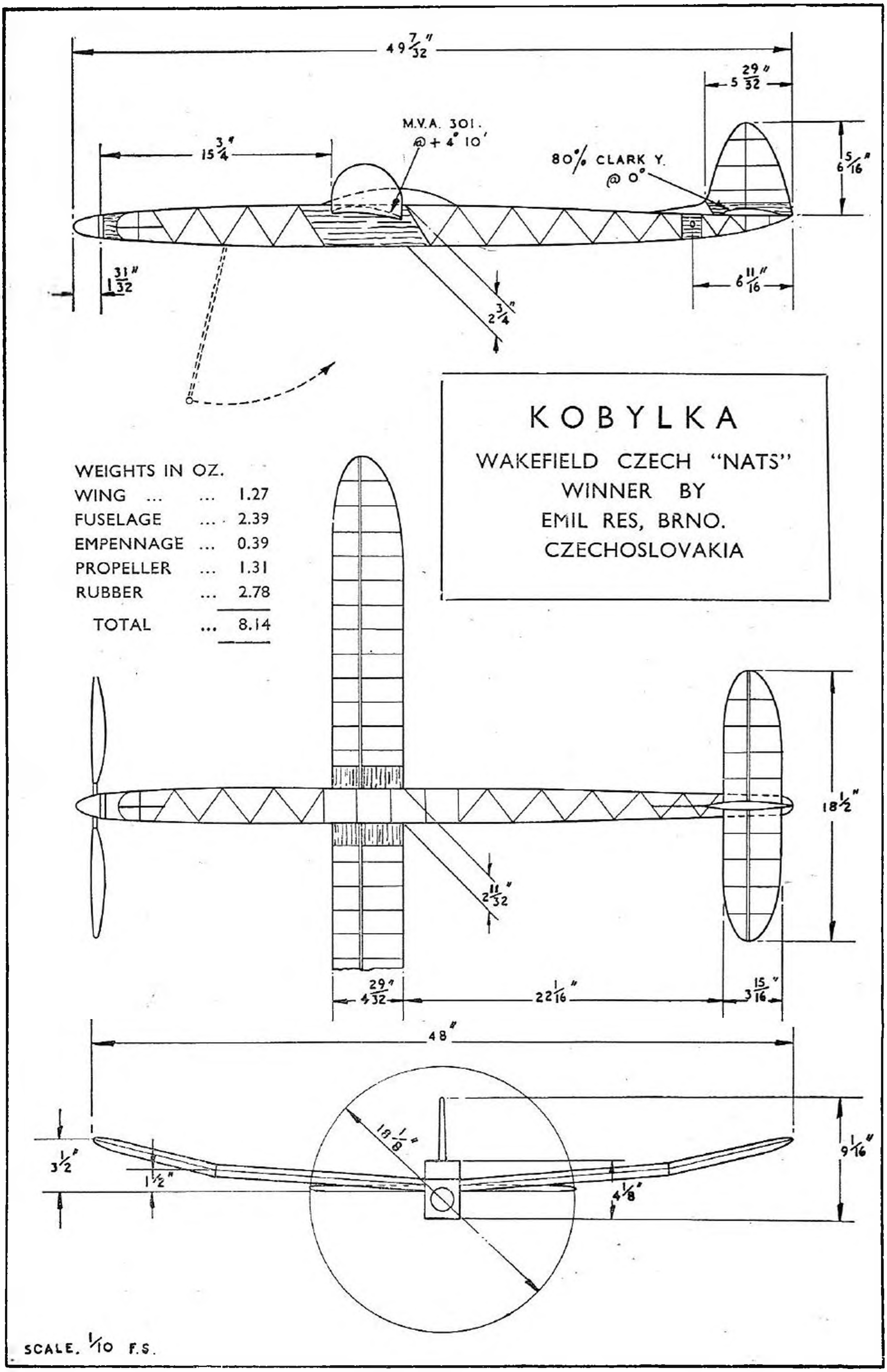
BELL 47 D-1 TRAINER, G-AKFB, belonging to B.E.A., is the bottom illustration. This is WHITE on top, pale COBALT BLUE on flanks, and aluminium underneath. MAROON flashes and black registrations. Rotor aluminium, on top, black below—Tail rotor aluminium, yellow tips.

The original colours in 1947, before being redoped in the present schemes were:—Sikorski S.51's (G-AJOR, G-AJOV, G-AKCU) Fuselage sides, tail boom and main rotors—VERY PALE GREY. Rotor pylon, spine, upper U/C legs—lettering and flash MAROON—Tail rotor as before—old B.E.A. flying key insignia in MAROON on WHITE circle. BELL 47's (G-AKFA, G-AKFB)—very pale grey fuselage with maroon underbelly, lettering, flash and U/C legs—rotors as before.



ROLL-O

STRAIGHTFORWARD U.S.
RADIO CONTROL MODEL
FOR UP TO 3.5 c.c. WITH
A GOOD CONTEST RECORD
By VINCENT J. BONNEMA
U.S.A.



49 7/32"
5 29/32"
M.V.A. 301.
@ + 4° 10'
15 3/4"
80% CLARK Y.
@ 0°
6 5/16"
1 31/32"
6 11/16"
2 3/4"
KOBYLKA
WAKEFIELD CZECH "NATS"
WINNER BY
EMIL RES, BRNO.
CZECHOSLOVAKIA
WEIGHTS IN OZ.
WING 1.27
FUSELAGE ... 2.39
EMPENNAGE ... 0.39
PROPELLER ... 1.31
RUBBER ... 2.78
TOTAL ... 8.14
18 1/2"
2 11/32"
4 29/32"
22 1/16"
3 15/16"
48"
18 1/8"
3 1/2"
1 1/2"
9 1/16"
4 1/8"
SCALE. 1/10 F.S.

PROP-SECRET
A "PSEUDO-JET" AIRCRAFT FOR 1.5 c.c.

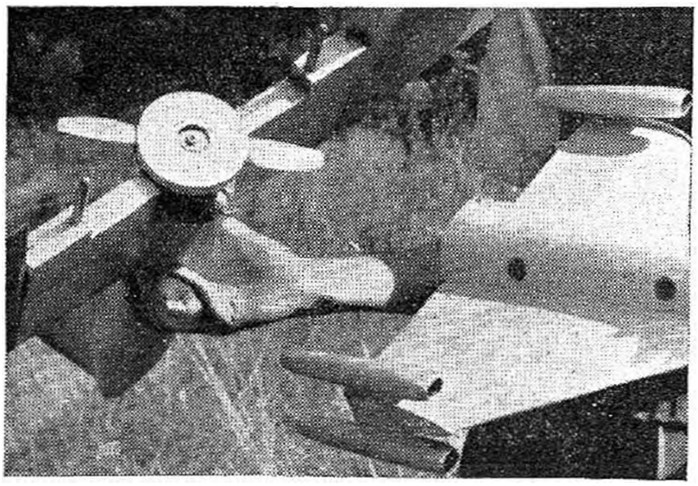
By W. P. HOLLAND

PROP-SECRET is the solution to the problem of airscrew position on a crescent wing, rather than any desire to be different. The first power flight of the original proved its efficiency, and with prop so concealed gives the appearance more akin to a crescent jet liner of the future.

Construction

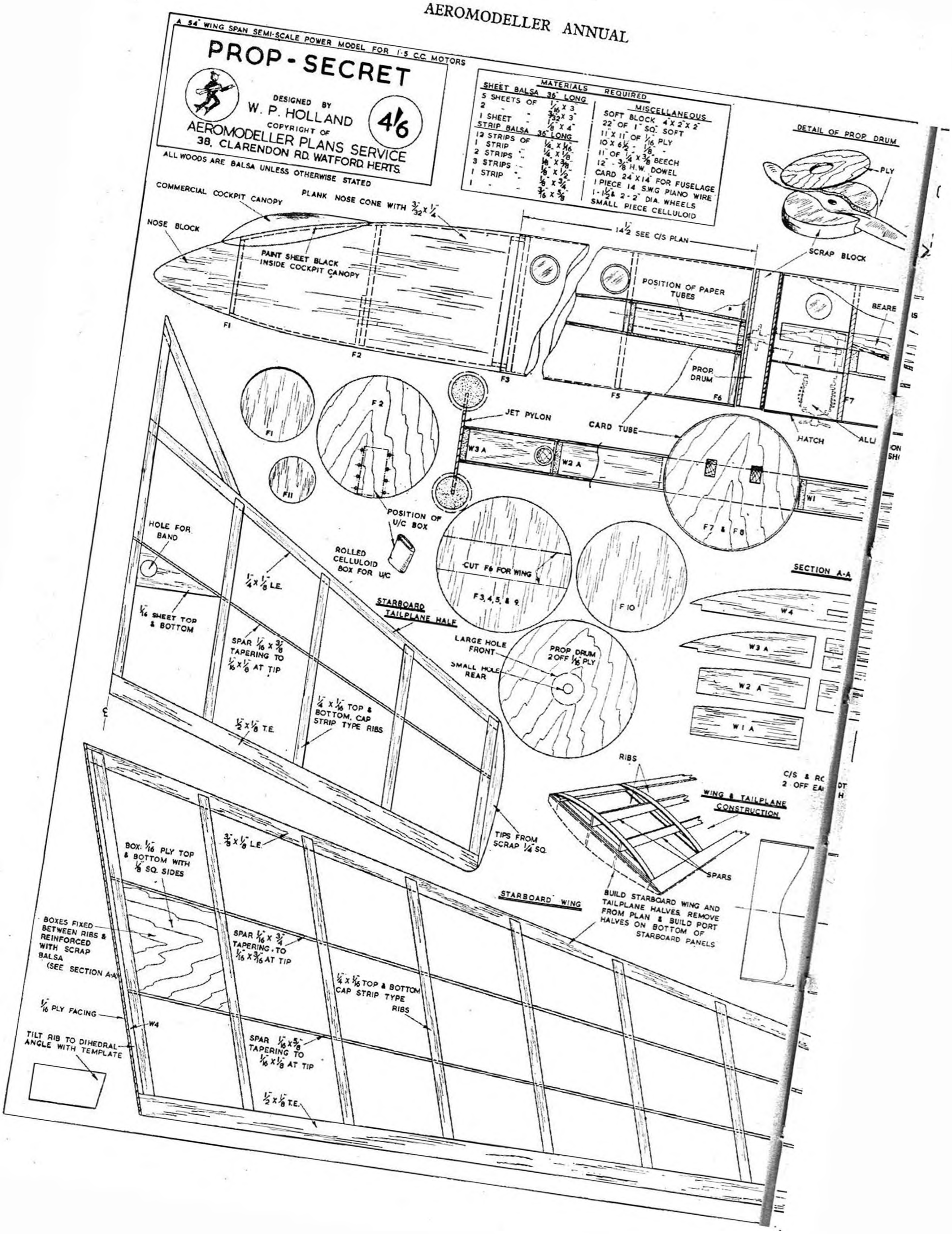
Main differences in building are card tube fuselage, and cap-strip wing ribs. Use $\frac{1}{32}''$ Bristol board for fuselage tube, lap joined at bottom, make $\frac{1}{8}''$ cross grained, jointing wings at ends, and plank nose and tail cones with $3/32'' \times \frac{1}{4}''$ strips. Make a solid job of wing C/S as this construction forms torsion boxes which hold nose and tail together via the two $\frac{3}{4}''$ dowels. Build up prop drum around a 9" x 6" E.D. prop and balance carefully. Trim prop to $8\frac{3}{4}''$ dia., this seems to leave very little area, however it is the part that usually gives most thrust.

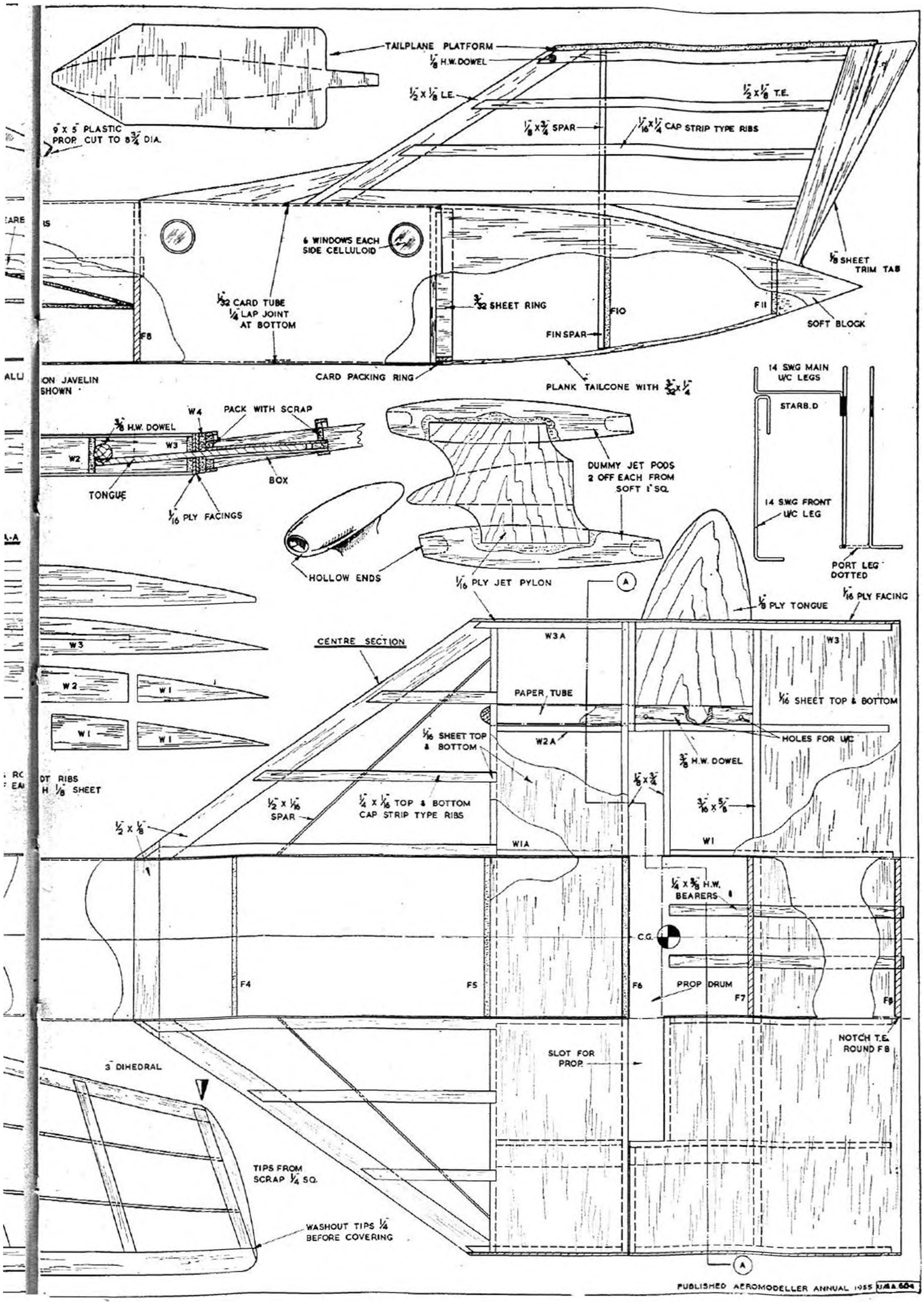
Starboard wing and tailplane halves are built in the following manner. Pin down L.E. and T.E. spars, add $\frac{1}{16}'' \times \frac{1}{4}''$ strips at rib positions, cement on tapered spars, and complete with further $\frac{1}{16}'' \times \frac{1}{4}''$ top ribs, $\frac{1}{4}''$ in. sq. tips and $\frac{1}{8}''$ sheet root ribs. When dry remove from plan, turn over, and pin further L.E. and T.E. strips to existing and so build port wing halves on bottom of starboard ones.



Cement tailplane halves together and add wing boxes *between* wing ribs. Plug on wing and prop up to dihedral angle before packing boxes round with scrap, and cementing.

All other details are quite straightforward.


A 54" WING SPAN SEMI-SCALE POWER MODEL FOR 1·5 C.C. MOTORS
PROP-SECRET
DESIGNED BY W. P. HOLLAND
4/6
COPYRIGHT OF AEROMODELLER PLANS SERVICE 38, CLARENDON RD. WATFORD HERTS.
ALL WOODS ARE BALSA UNLESS OTHERWISE STATED
MATERIALS REQUIRED
SHEET BALSA 35" LONG
5 SHEETS OF 1/16 X 3
2 - 3/32 X 3
1 SHEET - 1/8 X 4
STRIP BALSA 35" LONG
12 STRIPS OF 1/4 X 1/16
1 STRIP 1/4 X 1/8
2 STRIPS 1/8 X 3/8
3 STRIPS 1/16 X 1/2
1 STRIP 1/8 X 3/4
1 - 3/16 X 3/8
MISCELLANEOUS
SOFT BLOCK 4" X 2" X 2"
22" OF 1" SQ. SOFT
11" X 11" OF 1/16 PLY
10 X 6 1/2 - 1/8
11" OF 1/4 X 3/8 BEECH
12" - 3/8 H.W. DOWEL
CARD 24" X 14" FOR FUSELAGE
1 PIECE 14 S.W.G PIANO WIRE
1-1 1/2 & 2-2" DIA. WHEELS
SMALL PIECE CELLULOID
DETAIL OF PROP DRUM
PLY
SCRAP BLOCK
COMMERCIAL COCKPIT CANOPY
PLANK NOSE CONE WITH 3/32 X 1/4
NOSE BLOCK
PAINT SHEET BLACK INSIDE COCKPIT CANOPY
14 1/2 SEE C/S PLAN
POSITION OF PAPER TUBES
BEARE
PROP DRUM
F1
F2
F3
F5
F6
F7
JET PYLON
CARD TUBE
HATCH
W3 A
W2 A
W1
F2
F1
F11
POSITION OF U/C BOX
ROLLED CELLULOID BOX FOR U/C
CUT F6 FOR WING
F3, 4, 5, & 9
F10
F7 & F8
SECTION A-A
W4
W3 A
W2 A
W1 A
HOLE FOR BAND
1/4 x 1/8 L.E.
1/16 SHEET TOP & BOTTOM
STARBOARD TAILPLANE HALF
SPAR 1/16 x 3/8 TAPERING TO 1/16 x 1/8 AT TIP
LARGE HOLE FRONT
SMALL HOLE REAR
PROP DRUM 2 OFF 1/16 PLY
1/4 x 1/16 TOP & BOTTOM. CAP STRIP TYPE RIBS
1/2 x 1/8 T.E.
RIBS
C/S & RO
2 OFF EA
WING & TAILPLANE CONSTRUCTION
TIPS FROM SCRAP 1/4 SQ.
3/8 x 1/8 L.E.
BOX: 1/16 PLY TOP & BOTTOM WITH 1/8 SQ. SIDES
SPARS
STARBOARD WING
BUILD STARBOARD WING AND TAILPLANE HALVES, REMOVE FROM PLAN & BUILD PORT HALVES ON BOTTOM OF STARBOARD PANELS
BOXES FIXED BETWEEN RIBS & REINFORCED WITH SCRAP BALSA (SEE SECTION A-A)
SPAR 1/16 x 3/4 TAPERING TO 1/16 x 3/16 AT TIP
1/4 x 1/16 TOP & BOTTOM CAP STRIP TYPE RIBS
1/16 PLY FACING
W4
TILT RIB TO DIHEDRAL ANGLE WITH TEMPLATE
SPAR 1/16 x 5/8 TAPERING TO 1/16 x 1/8 AT TIP
1/2 x 1/8 T.E.


TAILPLANE PLATFORM
1/8" H.W. DOWEL
1/2" x 1/8" L.E.
1/2" x 1/8" T.E.
1/8" x 3/4" SPAR
1/16" x 1/4" CAP STRIP TYPE RIBS
9" x 5" PLASTIC PROP. CUT TO 8 3/4" DIA.
6 WINDOWS EACH SIDE CELLULOID
1/8" SHEET TRIM TAB
1/32" CARD TUBE 1/4" LAP JOINT AT BOTTOM
3/32" SHEET RING
F8
F10
F11
FIN SPAR
SOFT BLOCK
CARD PACKING RING
PLANK TAILCONE WITH 3/32" x 1/4"
ON JAVELIN SHOWN
14 SWG MAIN U/C LEGS
STARB.D
W4
PACK WITH SCRAP
3/8" H.W. DOWEL
W3
W2
TONGUE
BOX
1/16" PLY FACINGS
DUMMY JET PODS 2 OFF EACH FROM SOFT 1" SQ.
14 SWG FRONT U/C LEG
PORT LEG DOTTED
HOLLOW ENDS
1/16" PLY JET PYLON
A
1/8" PLY TONGUE
1/16" PLY FACING
W3A
W3
CENTRE SECTION
W2
W1
PAPER TUBE
1/16" SHEET TOP & BOTTOM
W2A
HOLES FOR U/C
1/16" SHEET TOP & BOTTOM
3/8" H.W. DOWEL
1/8" x 3/4"
3/16" x 5/8"
1/2" x 1/16" SPAR
1/4" x 1/16" TOP & BOTTOM CAP STRIP TYPE RIBS
1/2" x 1/8"
W1A
W1
1/4" x 3/8" H.W. BEARERS
C.G.
F4
F5
F6
PROP DRUM
F7
F8
NOTCH T.E. ROUND F8
3° DIHEDRAL
SLOT FOR PROP.
TIPS FROM SCRAP 1/4" SQ.
WASHOUT TIPS 1/4" BEFORE COVERING
PUBLISHED AEROMODELLER ANNUAL 1955 U.M.A. 604

SLOTS AND FLAPS

The behaviour of model aerofoils fitted with slots is generally disappointing, probably due to the small size of the slats involved. Basically the idea involved is that the incorporation of a slot within the complete aerofoil section "channels" the airflow over the upper surface and delays the point at which it will break away and cause the aerofoil to stall. Thus the fitting of a slot implies a higher stalling angle and, since this means an extension of the lift curve, a higher maximum lift. This is obtained at the expense of an overall increase in drag.

There are three main types of slots—the Leigh type which comprises a fixed auxiliary aerofoil or slat mounted in front of the leading edge; the Lachmann-Handley Page type in which the slat is mounted on linkage to retract flush with the wing surface; and "letterbox" slots formed through the main aerofoil itself.

The main use of slots on full size aircraft is to reduce the stalling speed. At any other speeds the added drag of slot is a disadvantage, hence the retractable-type slat is preferred, normal suction of the airflow being sufficient to pull the slat forward and open the slot as the wing approaches the stalling angle of the plain aerofoil. This automatic action is difficult to reproduce on model wings, hence if slots are used they are invariably of the fixed slat or letterbox type.

Thus it is virtually impossible to avoid the drag penalty using slots on models. Of the two, the letterbox slot appears to have the lower drag at normal flying angles and is also the least vulnerable. But both types tend to give an inferior lift performance below the normal stalling point, compared with a plain aerofoil.

An aerofoil with fixed slots, therefore, tends to be less efficient at all operating angles up to the normal stalling point of the section. No increase in performance (other than a slower flying speed) comes from trying to operate the aerofoil at a higher angle of attack and therefore the slotted wing is never seen on a model designed for duration performance. Virtually its only possible application in this direction—and even here the merits are debatable—is in using a slotted blade section on a rubber model propeller. Experiments in this direction have so far been discouraging.

As a stabilising device, however, the wing slot has been used to advantage on certain types of sports models. A primary cause of instability is a wing tip stalling, causing the model to roll towards that side where lift has suddenly dropped and drag increased enormously, and going into a spiral dive from which recovery may be rapid, or delayed, depending on the layout and trim of the model. A slot fitted to the outboard section of the wings, in such cases, will raise the stalling angle of the tips so that the centre of the wing now stalls first, which is generally a much safer condition.

Both fixed and letterbox slots can be used for this purpose, although they can be relatively inefficient unless positioned correctly. There is very little data available on this subject, but duplicating the configuration shown in Fig.1 should at least be reasonably near the mark. How much of the span of the wing should be slotted is a very open question, one half of the semi-span from the tip in being a normal maximum, with slot length frequently less. If the slots are too short, however, again their efficiency will be reduced. The actual slot itself, i.e. the gap between slat and wing proper or the letterbox slit, should be as unobstructed as possible.

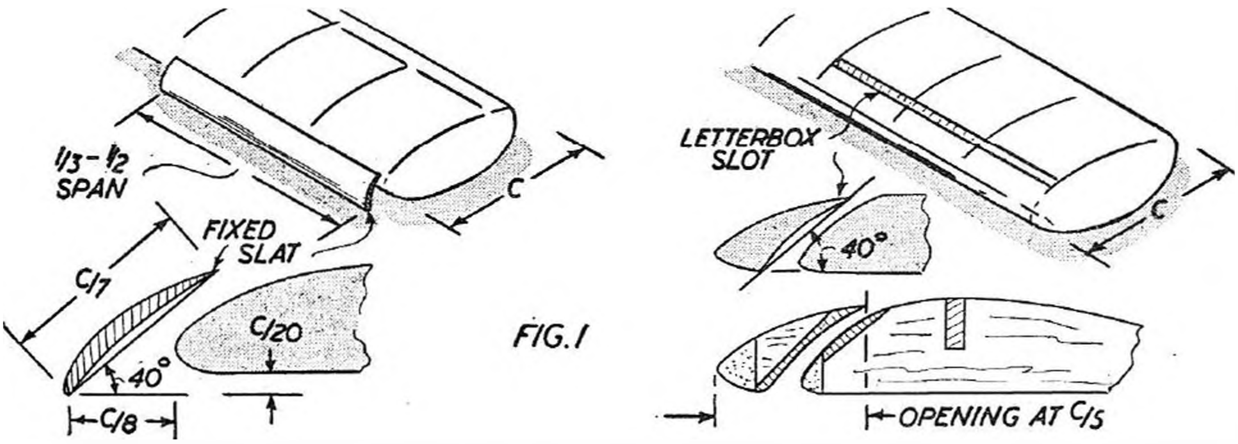


FIG. 1

The fixed slat is probably the best proposition since it can be cut off and re-positioned if it appears ineffective, and its best position arrived at by trial and error. A common mistake with a letterbox slot is to locate it too far aft and also to shape badly the top so that the airflow through the slot is not directed along the line of the aerofoil—both these factors contributing to reduced effectiveness.

In general, however, it should be possible to get comparable stability by using washout on the wing tips, or by arranging the design proportions so that tip-stalling, even if it occurs, will not be a critical stability factor. A slotted wing is only likely to be justified in such cases where design layout is limited, e.g. working to near-scale dihedral values. Wing tip slots have, however, been suggested as of possible advantage on gliders to increase towline stability, if a cure cannot be produced by simpler means.

A flap, on the other hand, which is a related high-lift device, can be most effective on many types of models. There are numerous types of flaps, ranging from the simplest types where the trailing edge of the aerofoil is drooped downwards (or a section of the lower surface lowered to produce a droop effect), to extendable-retractable or separately mounted auxiliary aerofoils mounted on or below the wing trailing edge—Fig 2. Nor need the application of flaps be limited to the trailing edge. Leading edge flaps ("droop snoot" aerofoils) are a comparatively modern development with model applications, e.g. Fig. 3.

Generalising, a simple flap is quite adequate for model work. The effect of a lowered flap is to increase both lift and drag and also move the centre of pressure of the wing forwards. Virtually it is equivalent to increasing the effective angle of attack of the aerofoil, which effective angle may well exceed the normal stalling angle of the section.

With flap angles up to about 10 degrees the increase in drag is small

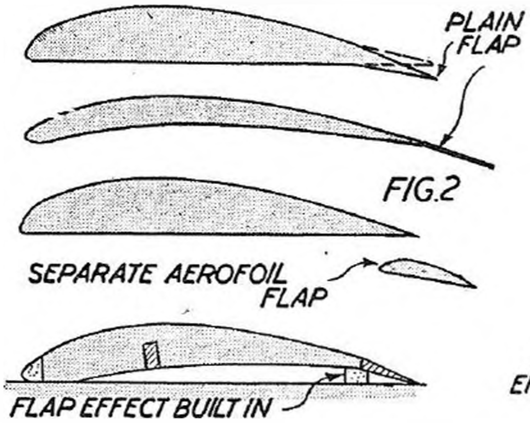


FIG. 2

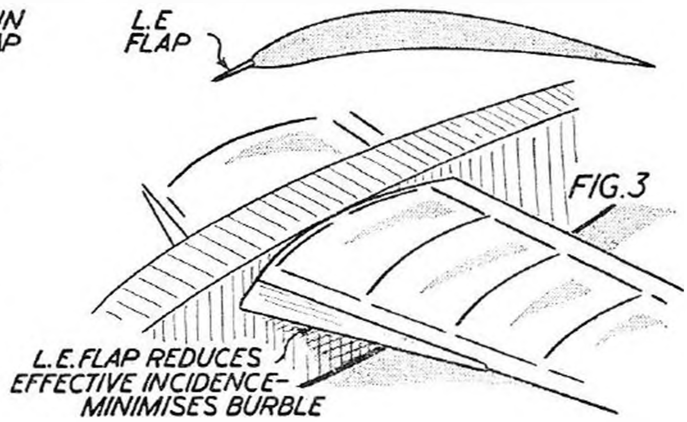
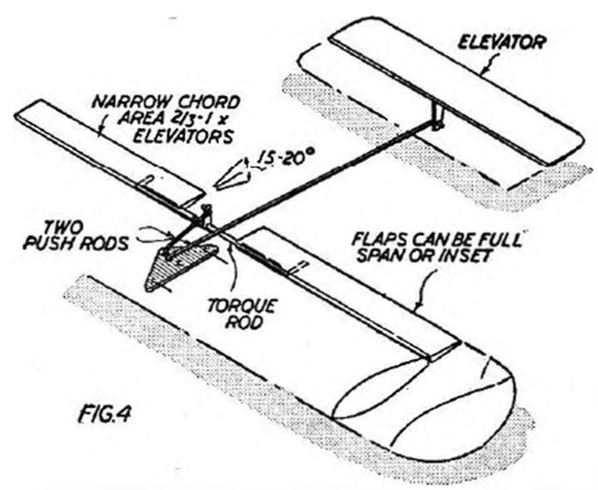
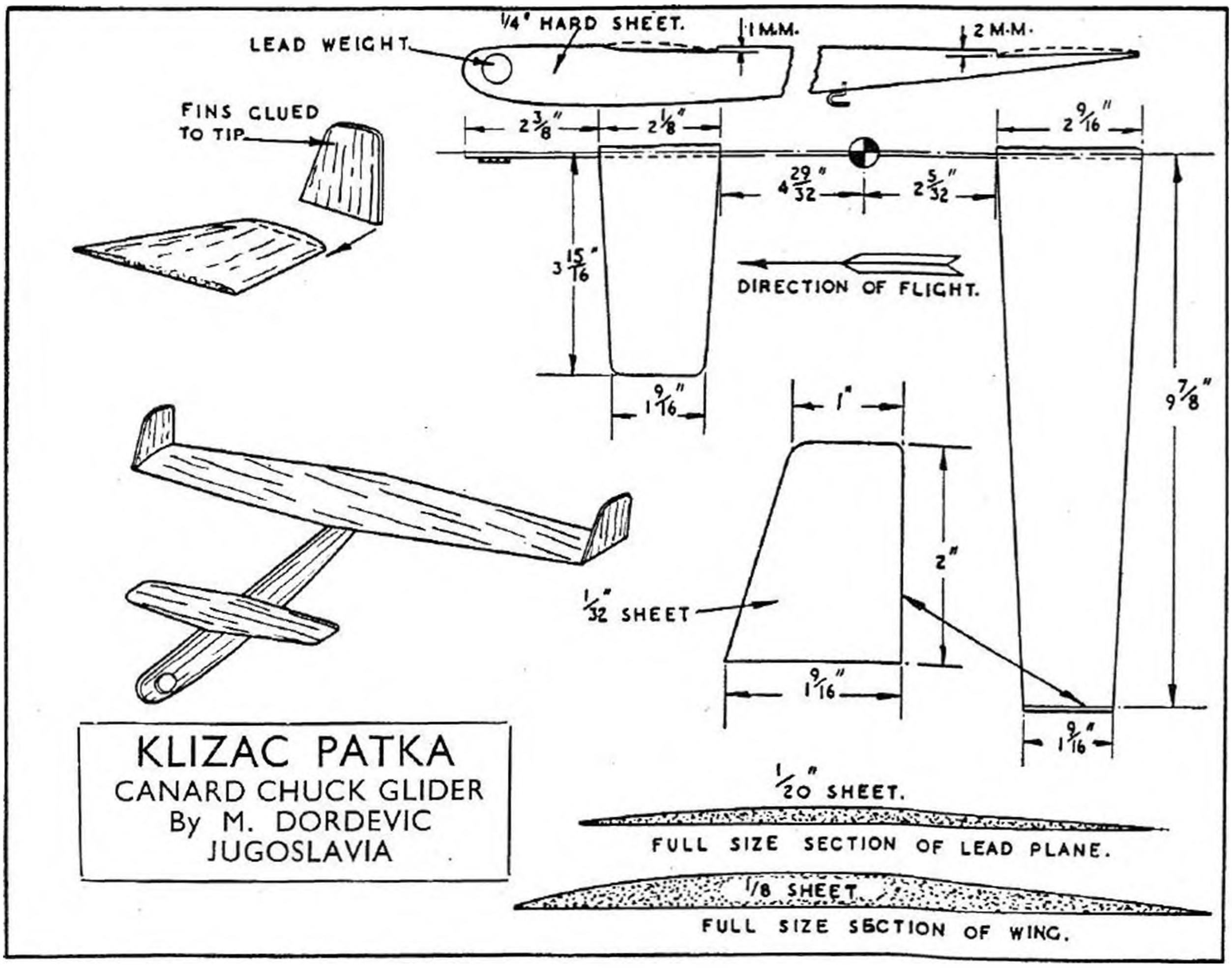


FIG. 3

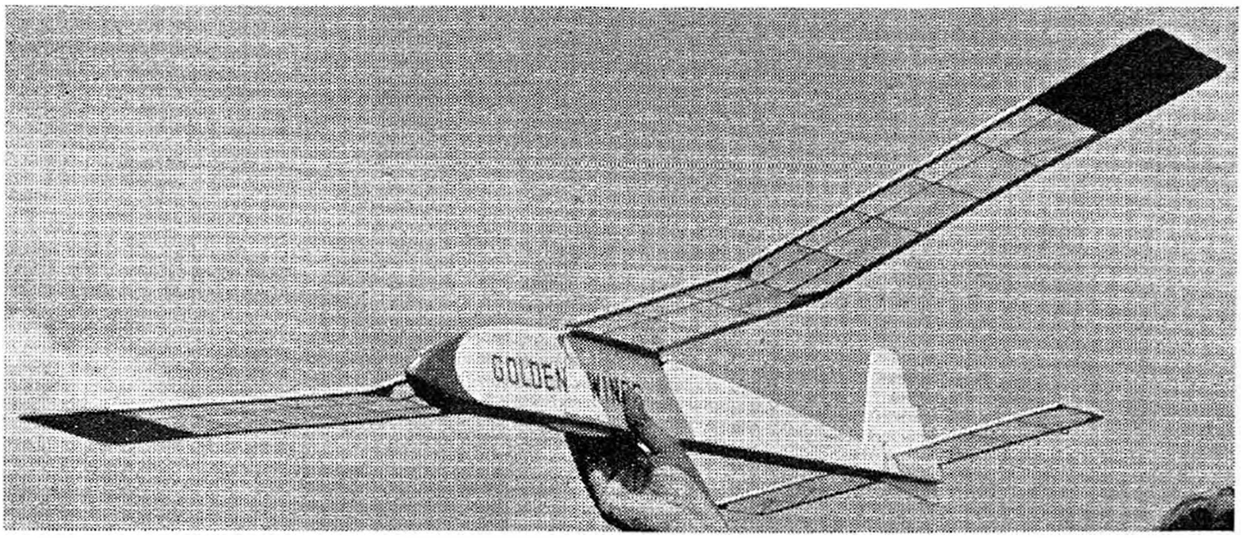


compared with the increase in lift, hence this range of flap can well be used on duration designs. It tends to make the model a little more critical on trim due to the centre of pressure shift and also is only really advantageous on the glide. Hence the full benefits of a fixed flap aerofoil can really only be realised on rubber models and gliders. Undoubtedly, however, the principle could well be extended to power duration models with the flap fixed at zero or even slightly negative (up) position for the power-on climb, then being automatically lowered to a glide trim angle.

Flaps, are, however, effective as control surfaces, as witness the coupled flaps and elevators used on certain control line stunt model designs. Flap effect is exactly opposite to that of the elevators, producing its reaction largely by centre of pressure shift. With quite moderate flap areas and movement it would be possible to effect longitudinal control by movable flaps only (i.e. use fixed elevators). But the effect is by no means as powerful as elevator control. Combining the two means that the elevator power can be reduced, making the model more smooth in response; or control response generally increased for a given elevator movement. Typical design proportions are summarised in Fig. 4.



KLIZAC PATKA
CANARD CHUCK GLIDER
By M. DORDEVIC
JUGOSLAVIA



The AEROMODELLER design, GOLDEN WINGS developed by Vic Smeed and the subject of an All Britain prize contest this year. Popularity of the class can be judged by four figure sales of the plan reached within two months of its publication

THE A-1 CLASS MODEL SAILPLANE

By J. VAN HATTUM

ALTHOUGH the A-1 class for model sailplanes has existed for some time in Central Europe and for even longer in the Scandinavian countries, it has only recently attracted general attention. It might therefore be worth our while to scrutinise it carefully and without bias, and to see where this will lead us.

In Scandinavia, aeromodellers felt the need to group their model sailplanes into well-defined classes for contest purposes. We may take it that one of the reasons was to eliminate the element of essential inequality when the average model had to compete against the ten-feet giants; a problem we have all had to face, and some of us still have to face.

Fundamental aerodynamic laws make it quite clear that the very large model has a bite on the smaller one on account of sheer size. Scale effect will make the larger model better aerodynamically from the very start, even when both models have been built to the same basic design and differ only in linear dimensions. Scale effect has resulted in complete failure when a model was built exactly similar to a high-performance sailplane; the model not only failed to duplicate the prototype's performance, it was not even up to the performance of models designed purely as models and of the same size.

Aerofoils, aspect ratios, wing plan, they have all been evolved for models, and differ greatly from those employed for full-size sailplanes. In other words: models are designed on lines which suit the models best, and the same applies to the full-size article, which, in turn, differs greatly in basic concept from the design of large powered aeroplanes.

With our models, we have constantly to remember that linear dimensions, and flying speed, bring them in a region where the airflow is under-critical, unless, and this is the point, we design them on a very large scale. The majority will fall in the group where the airflow is radically different from the airflow which we have to deal with when the aircraft flies at high speed, and when the linear dimensions are large. (Of the linear dimensions, the chord of the wing is here the most important.)

The very large model, with a wing-chord of, say, 12 in. will generally be flying in just above the under-critical region; the airflow will be above-critical, and this fact will lead to a more favourable flow over the aerofoil. As a result, the aerodynamic properties will be better; the lift/drag ratio will be higher, and the sinking speed lower.

The very large model lies somewhere on the way towards the full-size article in performance, and it derives its superiority from size, not so much as from design. By saying this, I do not want to belittle the large model, nor the considerable effort on the part of its designer. From the structural point of view, it is a much more difficult problem, since the larger the model becomes, the more vulnerable it will be in a rough landing, which may not cause any damage to its smaller colleague. Transport problems are formidable, and the cost of materials considerable.

I have by no means forgotten that our subject is not the A-2 class, but a new class, the A-1. The foregoing is essential because it should show that we are now once more at the crossing of the ways. The A-1 has even been put forward as the replacement for the A-2, which, as some think, has shown too high a performance under the existing contest rules. Whether it might not be better to modify these rules to allow for increased performance, rather than scrap this class which already has won so much affection all over the world, is a matter which deserves careful thought. I may here add that such a drastic change is not planned by the F.A.I., but the CIAM certainly looks with interest upon the A-1 which might yet play a part in the international contest scheme.

However, for the moment, our task is to look more closely into this specification and see what possibilities are offered there. For here again we are faced with the trend of the "still smaller", which would give fuel to the fires of wrath lit by those who regarded the adoption of the A-2 as a return to the "toy aeroplane" . . .

The A-1 specification implies a small model by any standards; the total horizontal area as defined by international rules is limited to 18 square decimetres, which is equivalent to 280 sq. ins., not a great deal over half the 527 sq. ins. maximum allowed the A-2. This means that an A-1, scaled down faithfully from a prototype A-2 would have linear dimensions about 0.73 times that of its parent model. We shall never quite do that, but it serves to give an idea of the size.

The small size of the model must be kept in mind all the time, for this factor will largely influence design if we want to get the best performance to be obtained. Again, if we keep to international rules concerning the wing loading, the model will inevitably have an inferior performance to the larger model. Since, however, we find that both large A-2 and small A-1 models will fly in under-critical conditions, the gap will not be so large as was the case with the "giant" and the A-2. And all we have meanwhile learned about this class, especially the manner in which the airflow may be coaxed to behave in an acceptable way, can now be applied to improve the performance of the smaller model. In other words; a properly designed A-1 may yet show up very well, provided great care is taken in its design and construction.

Here we must make up our mind what we will demand from the model. The specification lends itself excellently to a simple beginners' model; there are, in fact, a great number of kits on the market which fit into the A-1 class and some of these have shown very good possibilities. In my opinion, the A-1 will draw its greatest strength from its suitability in this field. The beginner deserves all our attention as he will be the leading designer of the future, and everything should be done to put him on the right track at the start of his career in aeromodelling.

Since there is no lower limit to the A-1, any model with a total area of less than 280 sq. ins. will be eligible, but it stands to reason that it pays to work as closely to the limit as possible, except in cases where cost of materials overrules all other considerations. It must be remembered that, although the smaller the model the cheaper the outlay in first costs, it does not by any means follow that construction becomes easier with reduction of size, and this certainly does not apply to trimming problems which often become greater the smaller the model. The maximum area allowed being really small, there is no reason why we should not work right up to it and use it all.

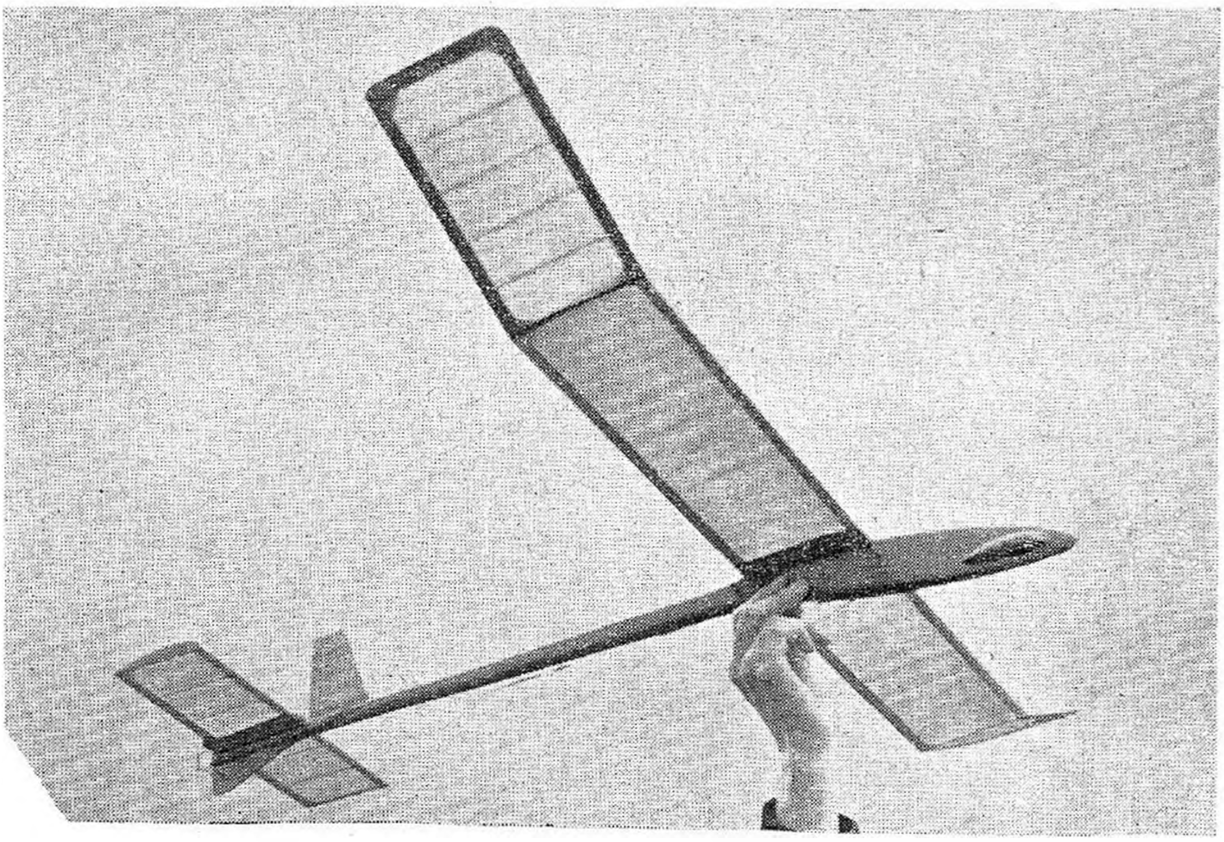
In the writer's opinion, the A-1 specification might well follow the lines of the A-2, with a minimum as well as a maximum total area sharply defined. This might put the A-1 within the limits of 17-18 square decimetres; 265-279 sq. ins. At the risk of severe criticism from A-1 supporters, I would even suggest a slight up-grading to 18-20 square decimetres (280-310 sq. ins.), but that suggestion may be rooted in the same conservatism which led many of us to regard the A-2 specification, when it came up for consideration, as giving too small a model. At any rate, we here have to deal with the A-1 as it has been used and stands at the present moment.

We may now make a sharp distinction between the A-1 designed for simplicity as an ab-initio model, and the A-1 intended for contest flying where any refinement will be used to obtain the best performance possible.

The Simple A-1

The design may vary between the extremely bare and elementary, and the more elaborate beginners' model. The former might probably better be left to the really small model which is from the start intended to be very easy to make and cheap to build. This type would be the most suitable to give to

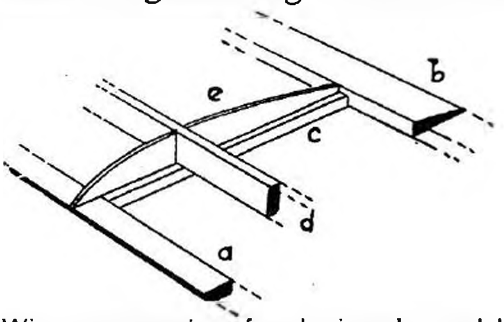
The Junior V, a popular Italian kit model which conforms to their National Junior Class, specification for which coincides with the new Nordic A/1 Class discussed in this article.



very young boys in order that they learn the rudimentaries of working the materials, and real contest flying does not yet come into it.

The slightly more elaborate A-1 would be ideal to introduce the beginner to some of the constructional and flying problems which the builder is to meet later.

Design of a beginners' model is always a compromise, and much of the success will depend on the designer's ability and feeling for just what will appeal to the beginner and will still lies within his ability. If a beginners' model is too simple, it may lack appeal and performance, while it also fails to teach the "first steps" and leaves him with the same problems to face when he tackles the next and more ambitious job. In many cases, major decisions on layout and structural details may be even more difficult than in the case of the high-performance model as one must constantly test any scheme on the basis of the builders' very slender abilities. When some details are too tricky, they may cause the failure of the design to win approval, even when the general layout may be commendable. At the same time, the design should enable the builder to put in quite a lot of flying of a reasonably high standard in order that he shall have the grounding to trim his next model according to the book.



Wing construction for beginner's model "Mentor" which appears on page 53. Building sequence is a-b-c-d-e

I see the A-I beginners' model as a fairly simple job but with enough built-in complication to serve as Lesson No. 2 after the very first small job which only serves to teach the essentials of building and trimming. Much depends on whether the model will be built under guidance and with expert advice, but the designer will be wise not to rely on this. "Mentor", a model of this type designed by the author, appears on page 53.

We will go more fully into the design-problems of the contest type A-1 and it will be clear that a model as discussed above may well be derived by simplication of such a design, the more so since the performance model may still be quite simple in many details.

The Contest A-1

The A-1 will probably only come into its own when it becomes accepted as a separate official class, for it will never be able to compete with the much larger A-2. Here a lead could be given by the F.A.I. while National Aero Clubs could study the possibilities of adopting this class. I am not concerned here with the considerable problems of checking models before a contest!

The design should take every advantage of recent developments to increase performance. The A-1 should, in my opinion, conform to the minimum wing-loading as specified for the A-2 and F.A.I. classes. If we fail to do this, we shall get floating bits of balsa and tissue which could only be called toys. This would put the minimum weight of the top-size A-1 at 216 grammes, that is $7\frac{3}{4}$ ounces. If we stay below this trouble starts with records, etc.

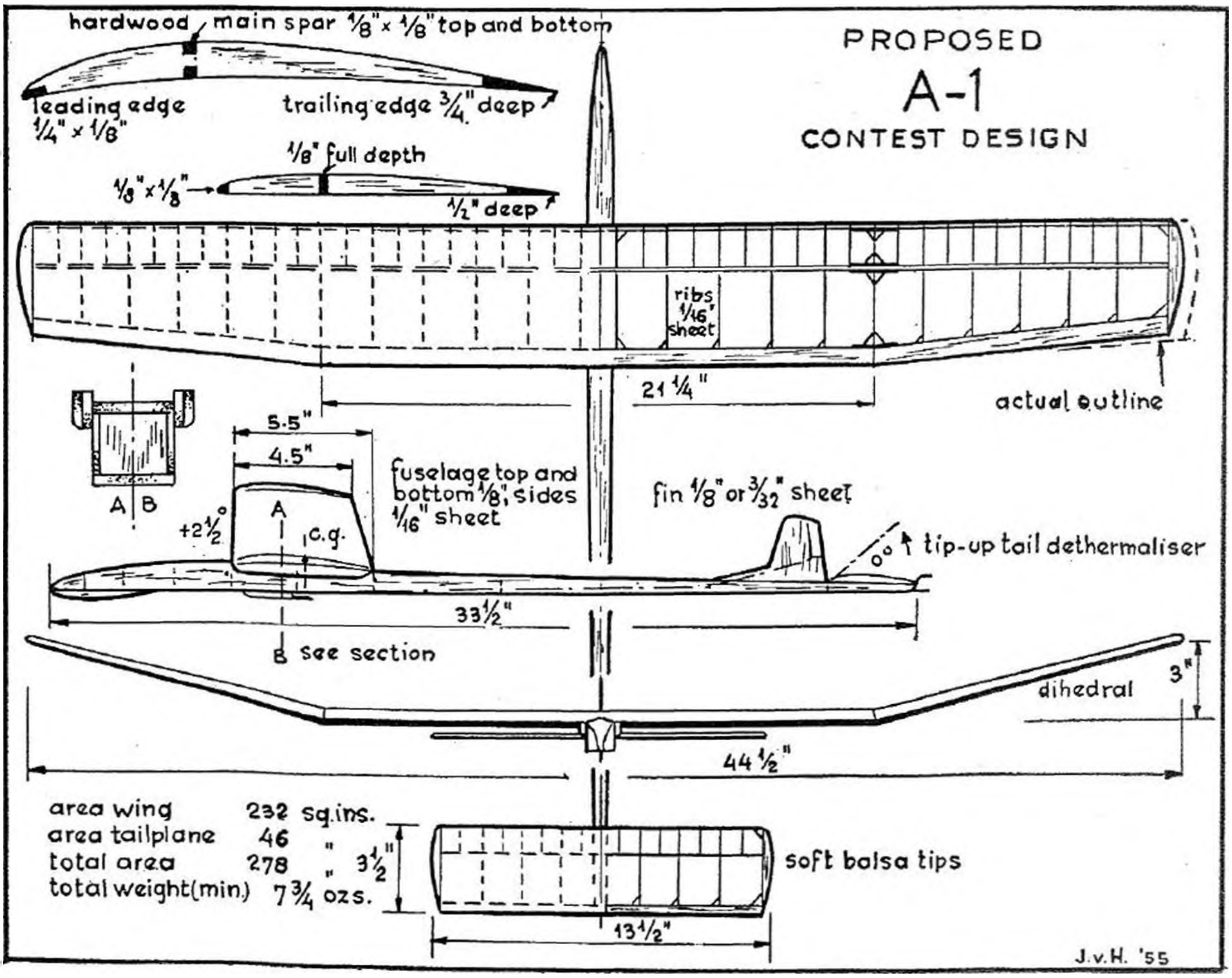
A suggested set of layouts is given here, and the reader may find it useful to criticise them and introduce his own ideas on the subject. Let me here explain the reason for my choice.

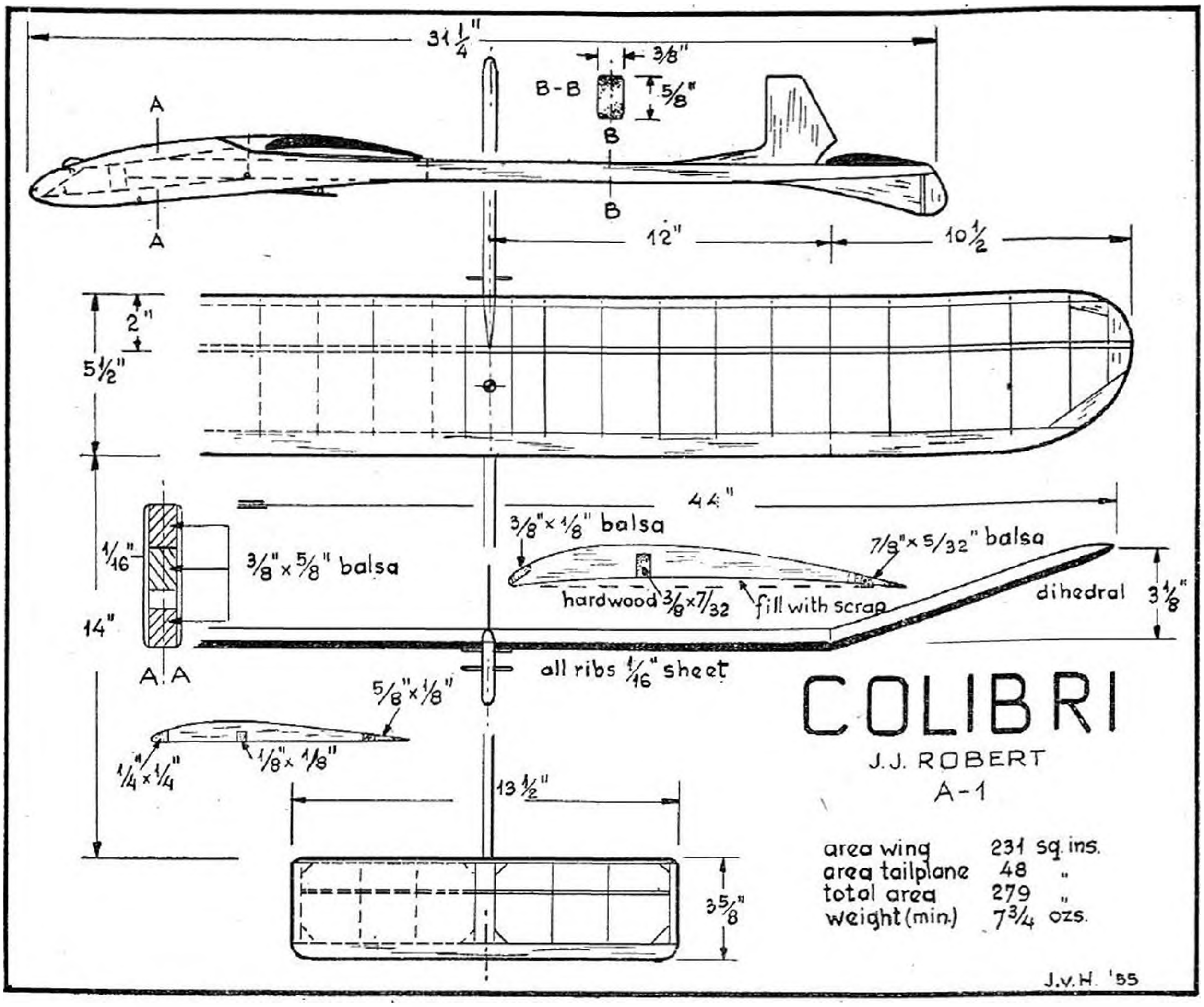
First we must decide how we will divide the total area between wing and tailplane, using normal proportions with a relatively long moment arm. If we take the moment arm as the horizontal distance between the c.g. and the midpoint of the chord of the tailplane and use a tailplane area of 20% of the wing area, this moment arm will have to be about 4 to 4.5 times the mean wing chord. Multiplying moment arm/wing chord with tailplane area/wing area, we get: 4.0 x 0.2=0.8. This is a very acceptable figure which in most cases guarantees sufficient longitudinal stability. (Using the longer moment arm we obtain the figure 0.9 which is on the high side.) It would mean that a reduction of tailplane area to about 18% is possible, were it not that the very diminutive tailplane may be expected to be somewhat inefficient. We would, therefore, be in favour of the former arrangement, and this has been incorporated in the layouts shown here.

We will now consider the main components from a general point of view, after which we will deal with the structural aspect.

Wing

Since scale effect dictates the use of a reasonably large chord, we shall have to keep the aspect ratio fairly low as compared with the average A-2 design; say about 8. (The A-2 may use A.R. 12 or more!) Using a 20% tailplane we find that this will have an area of about 46 sq. ins. with a wing-area of about 234 sq. ins. The total, being just 280 sq. ins. may be a bit on the high side, as any modification during design and construction may lead to exceeding the limit. The best way to deal with this will be to design the outline of wing and tailplane to the limits given and remove a little area by trimming off the tips. We must remember that in the case of the wing allowance must be made for dihedral; in other words, the actual area of the panels which make up the wing will be of greater area than the projection on a horizontal plane.



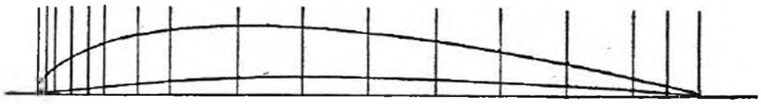


As the chord should not be small, we choose 5.5 ins. as an acceptable compromise and this gives a nett span of a rectangular wing of 42.5 ins. with an A.R. of 7.75. We may try to go one step further and use tapered outer panels with a tip-chord of not less than $\frac{2}{3}$ of the main chord. This will slightly increase the span and hence the A.R., with little risk of loss of efficiency, provided we reduce the chord to not less than 4.5 ins. This will raise the nett span to 44.25 ins. and the effective A.R. (A.R.= Span^2/Area) to 8.2 approx.

In the writer's opinion, there may not be very much to choose between the "straight" wing and the wing with tapered outer panels. Efficiency may be slightly better in the case of the latter which also has some structural advantage regarding torsional strength. It is a matter of compromise and personal taste, and the amount of time one is prepared to spend on design and building. Both layouts are given in the sketches.

Dihedral, indispensable for lateral stability, can be obtained by sweeping the outer panels upwards which is well suited to a wing with tapered outer panels and gives excellent stability and good towing characteristics. Simple V-dihedral can also be used and this is particularly suited to the simple beginners' type.

Having settled the plan-form of the wing, we now have to choose the type of aerofoil best suited to this model. Here we have to keep in mind that the chord is small, and it will be essential to select an aerofoil which may be expected to suit the particular conditions under which the wing has to work. Small chord and relatively low speed lead us to the choice of thin well-cambered aerofoil



The MVA aerofoil reduced to 75% about the centre-line

with the maximum camber of the upper surface well forward, little camber in the tail portion and a small nose-radius. Such aerofoils do not have to be created; many already exist from which we can take our pick. I would choose MVA 173 or MVA 301 reduced to 75%, which possess most of the desired characteristics and sufficient useful depth to accommodate the structure. Here is another factor which will tend towards the choice of a generous chord; a small chord will result in a thin wing which presents considerable structural problems.

Various arrangements of spars are possible, and the designer must make his choice, keeping in mind that with a small model any complication becomes more so and may not lead to the expected saving on structural weight. One of the attractive points of the A-1 specification is the automatic elimination of the smaller design problems which form both the headaches and attractions—depending on the way one looks at it—of the A-2. With a total weight of just under 7¾ ounces extreme refinement will really not pay. Straighforward robust design serves an A-1 best.

Since the loads on the wing will be small, even during a fast towline launch, a single stout main spar, placed in the upper contour of the ribs will give a sufficiently strong structure, but the writer would prefer an arrangement of top and bottom spar which facilitates assembly, is more efficient and gives better support to the ribs, while it makes the dihedral easier to incorporate.

A single spar as above, supported by balsa nose-sheeting may, at first sight, seem an improvement, but this leads to more complication and the modern trends appear to be towards close spacing of the ribs with extra nose ribs in the forward section up to the position of the main spar. It does mean making a lot of ribs, but the assembly is quite straightforward and presents no problems.

With the narrow tail of modern aerofoils and the size of the chord as chosen, a built-up trailing edge—otherwise a good warp-resisting feature—will be difficult to incorporate so that we will have to use a solid trailing edge with generous depth. Attachment to the ribs by means of small gussets is to be preferred to notching the trailing edge which weakens this member at the worst place.

Simple reinforcements serving as dihedral-keepers on leading and trailing edges as well as main spar, can be made from hard balsa, but 2 mm three-ply should remove all future worry from the designer's mind.

The wing can be built entirely from balsa, provided that a really hard grade is chosen for the main spars. Hardwood spars would be a sound choice, however, especially as the smaller sections permissible can be more easily accommodated in the aerofoil.

With the small span there is no need to split the wing for transport, and the straight-through wing eliminates a large amount of design work and time in building. Attachment by rubber-band can be so designed that excrescences are limited to a minimum.

In the case of the simple model many of the factors dealt with above can be ignored and structural simplicity given first place. The use of aerofoil with flat lower surface makes special forms of construction possible, and facilitates building. Schemes which would lead to excessive weight in a large model may be quite acceptable here since the small size will stand extreme simplification.

The Fuselage

Here the designer can choose between the simple stick, and the slender fuselage. In the writer's opinion, the latter is much to be preferred as it combines strength, stiffness, low weight, and good looks. The stick, simple as it may seem, tends to be weak on stiffness and rigidity, although admittedly, the small size of the A-1 makes this a much better propostion than in the case of the A-2. A solid stick will, however, be much too heavy so that we shall have to use a built-up structure in which case we can copy from various well-known schemes. The sketches show a form of fuselage construction used in many designs. Formers, spaced generously along the length, serve to assist torsional stiffness, and take local loads where needed.

The fuselage—or stick—being narrow we must arrange for sufficient width to give proper seating to the wing and tailplane, as trim will be badly affected when these components are not firmly seated. We can cement slender blisters on runners to the fuselage or add a simple platform for them to rest on. Minimum width of seating for the wing would be about $1\frac{1}{2}$ ins; it is better to have more than too little.

Sheet $\frac{1}{16}$ in. thick would be all right for bottom, top and sides but only when the cementing is very carefully done. Using $\frac{1}{8}$ in. top and bottom will give considerable additional strength with little increase in weight, while it provides more rigidity during assembly.

If the fuselage is kept narrow with rails cemented on to support the wing, the width of the fuselage may be kept constant, enabling one to use standard sections for top and bottom, say $\frac{3}{4}$ in. x $\frac{1}{8}$ in.

The nose should not be very short in my opinion. I have not yet seen any good reason to put forward for using a very short nose while there are reasons for having generous side area in front of the c.g. A good average would be $1\frac{1}{4}$ to $1\frac{1}{2}$ times the main chord of the wing. The section of the fuselage forward of the wing could be solid balsa, which lends itself well for shaping to an attractive form. Laminated $\frac{1}{4}$ in. balsa would probably be better than a plain block, but this would use up a good deal of cement. The extreme tip of the nose should be made of hardwood to take impact on collision which would soon dent and spoil a balsa tip.

Attachment of the wing would be by means of hardwood pegs, taking the rubber bands; these could be placed half-way the height of the fuselage.

A short 2 mm three-ply skid has been found very useful to take landing impact, while it gives a characteristic line to the rather severely straight fuselage.

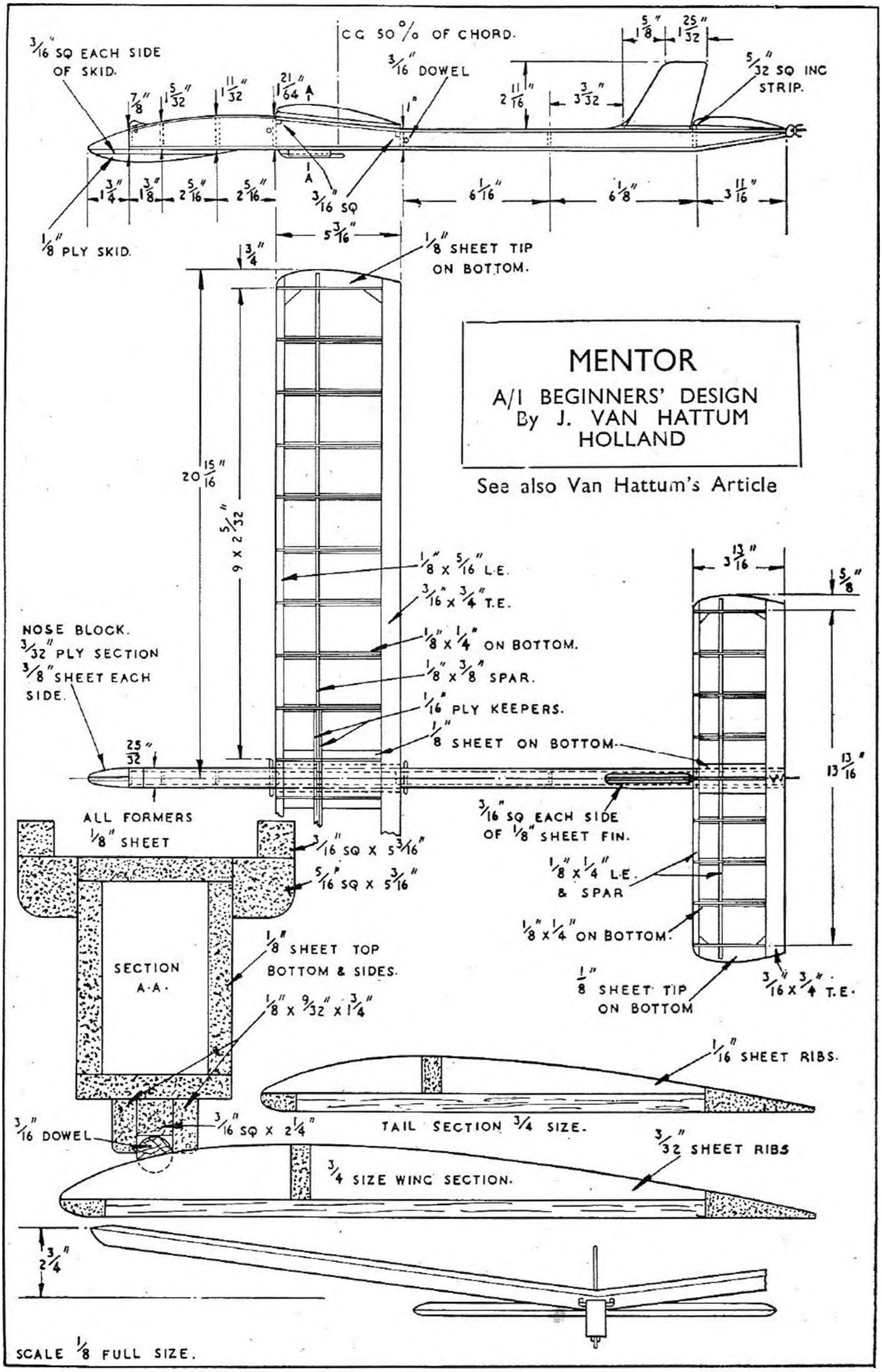
Tail Unit

The writer prefers a fin built up of $\frac{1}{8}$ sheet balsa, cemented straight onto the fuselage so that no trouble can occur with alignment. An auto-rudder is very useful; opinions differ as to whether this should make the model turn to the right or the left! A small strake improves the lines while it gives support to the fin.

The tailplane could be built on the same lines as the wing, but with the small size it would pay to simplify the layout. A solid spar of the full depth of the rib makes building very simple.

All tips—both wing and tailplane—can be made from soft scrap balsa and elaborate elliptical tips have no place in this type of model.

A dethermaliser tip-up tail should always be incorporated; any model of today is likely to fly away in a thermal, and this applies to the simple beginners' version as well as the contest type A-1.



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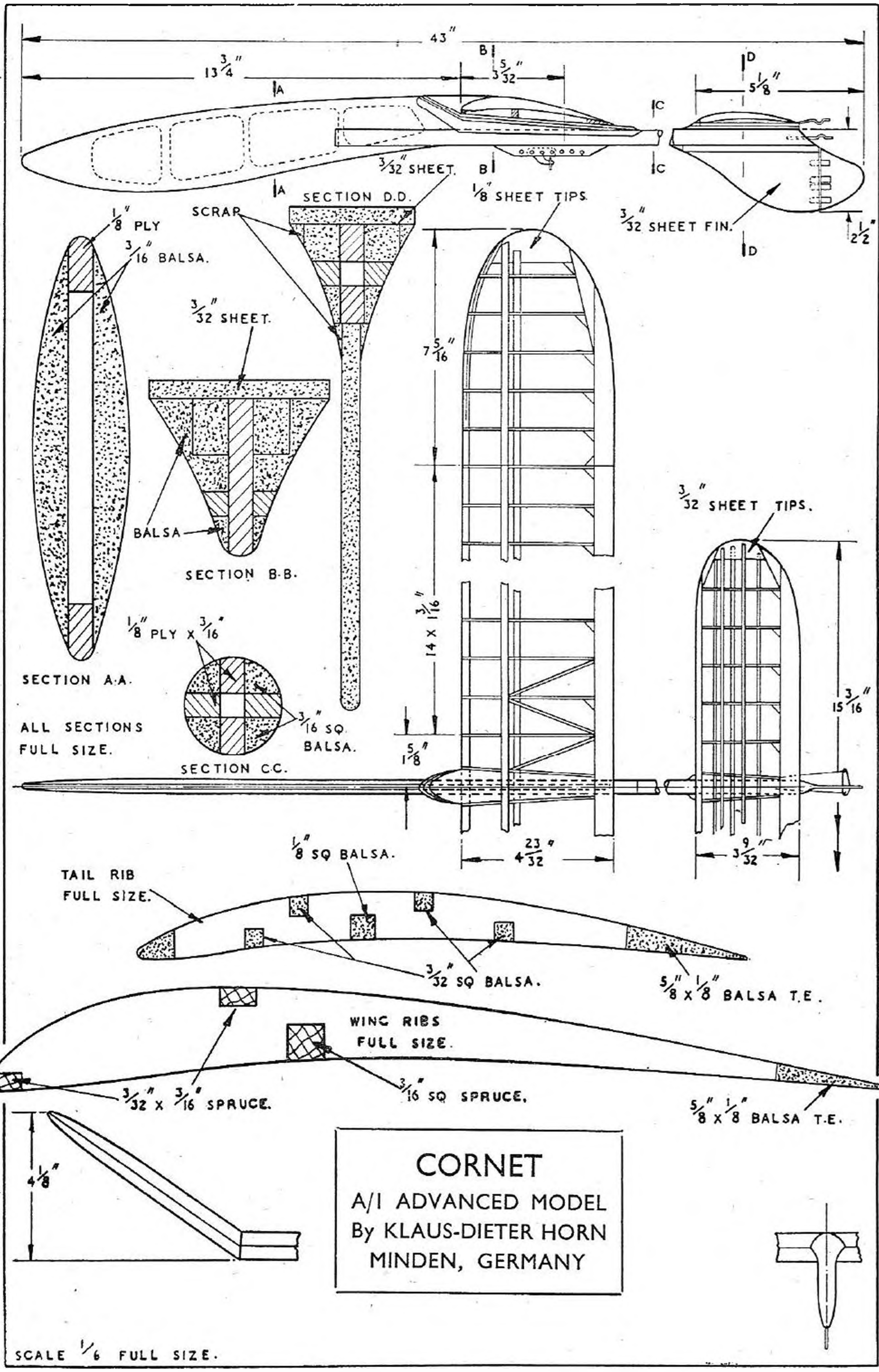

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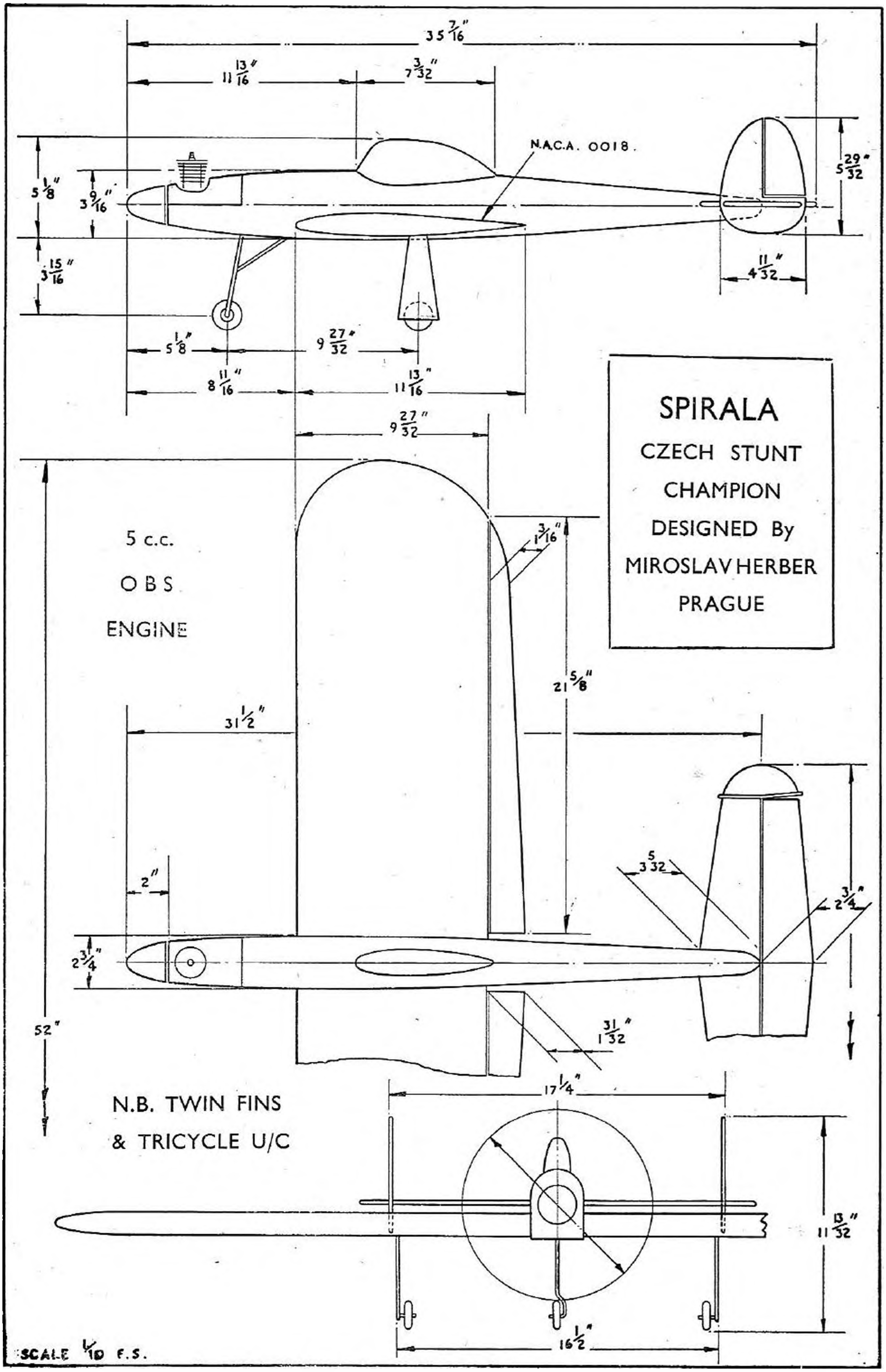
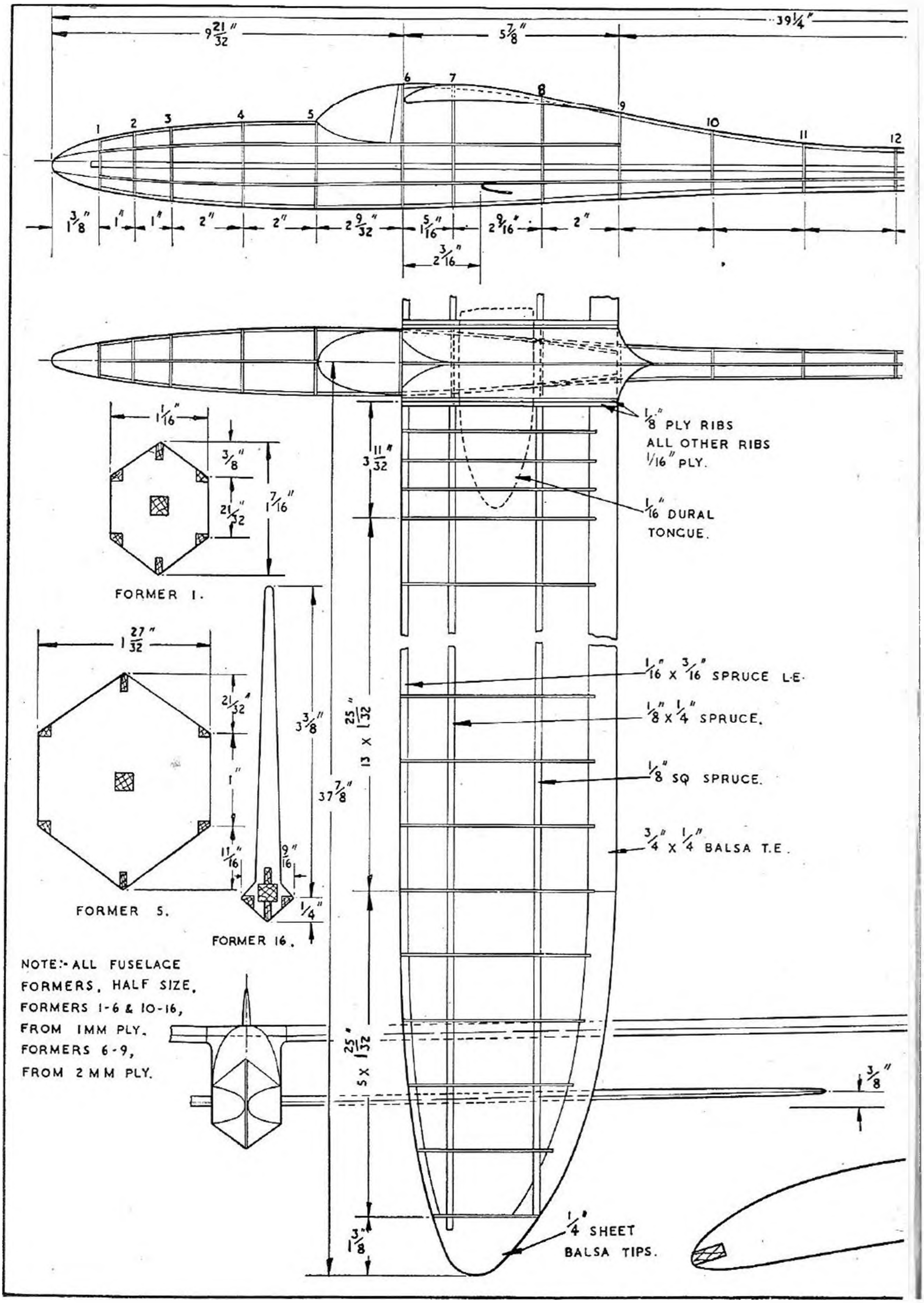
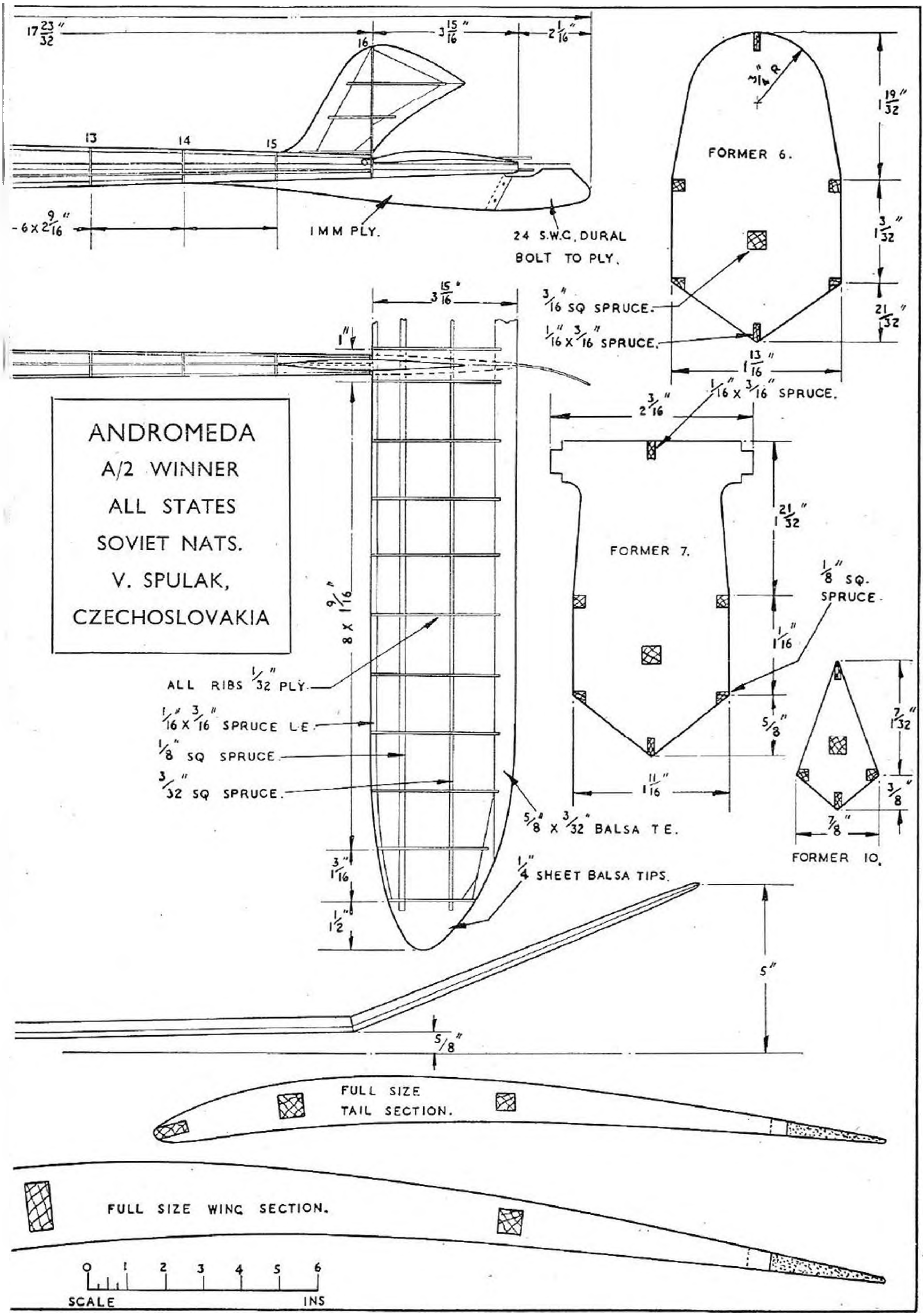

SPIRALA
CZECH STUNT
CHAMPION
DESIGNED By
MIROSLAV HERBER
PRAGUE
5 c.c.
O B S
ENGINE
N.B. TWIN FINS
& TRICYCLE U/C
N.A.C.A. 0018.
35 7/16"
11 13/16"
7 3/32"
5 1/8"
3 9/16"
3 15/16"
5 29/32"
4 11/32"
5 1/8"
9 27/32"
8 11/16"
11 13/16"
9 27/32"
1 3/16"
21 5/8"
31 1/2"
2"
2 3/4"
3 5/32
2 3/4"
1 31/32"
52"
17 1/4"
11 13/32"
16 1/2"
SCALE 1/10 F.S.


39¼"
9 21/32"
5⅞"
1 2 3 4 5 6 7 8 9 10 11 12
1⅜" 1" 1" 2" 2" 2 9/32" 1 5/16" 2 9/16" 2"
2 3/16"
1/8" PLY RIBS
ALL OTHER RIBS
1/16" PLY.
1 1/16"
3/8"
21/32"
1 7/16"
3 11/32"
1/16" DURAL
TONGUE.
FORMER 1.
1 27/32"
21/32"
1"
3⅜"
11/16"
9/16"
¼"
FORMER 5.
FORMER 16.
13 x 1 25/32"
37⅞"
1/16" x 3/16" SPRUCE L.E.
1/8" x ¼" SPRUCE.
1/8" SQ SPRUCE.
¾" x ¼" BALSA T.E.
NOTE:- ALL FUSELAGE
FORMERS, HALF SIZE,
FORMERS 1-6 & 10-16,
FROM 1MM PLY.
FORMERS 6-9,
FROM 2MM PLY.
5 x 1 25/32"
3/8"
1⅜"
¼" SHEET
BALSA TIPS.


ANDROMEDA
A/2 WINNER
ALL STATES
SOVIET NATS.
V. SPULAK,
CZECHOSLOVAKIA
FORMER 6.
FORMER 7.
FORMER 10.
1MM PLY.
24 S.W.G. DURAL BOLT TO PLY.
3/16 SQ SPRUCE.
1/16 X 3/16 SPRUCE.
1/8 SQ. SPRUCE.
ALL RIBS 1/32 PLY.
1/16 X 3/16 SPRUCE L.E.
1/8 SQ SPRUCE.
3/32 SQ SPRUCE.
5/8 X 3/32 BALSA T.E.
1/4 SHEET BALSA TIPS.
FULL SIZE TAIL SECTION.
FULL SIZE WING SECTION.
SCALE
INS

METAL CONSTRUCTION

MAGNESIUM, lightest of the structural metals, weighs about twelve times as much, and aluminium twenty times as much, as balsa, which is only partly offset by the smaller metal sections which can be used for similar strength. Whereas metal sections can readily be adapted to full scale aircraft construction, scaled down sections are not practical for model work because of lack of local stiffness. Hence an all-metal airframe must, inevitably, work out heavier than its all-balsa counterpart.

Nothwithstanding, metal airframes for models were developed to some considerable degree in Germany in the years just before the war, utilising special tools for forming and riveting assemblies. More recently there has appeared in this country the first completely prefabricated all-metal model kit, employing extruded sections in magnuminium (a magnesium alloy) and pressings in 33 s.w.g. aluminium sheet with clip fasteners. The resulting model, which can be assembled with the minimum of tools, is a 38 in. span free flight sports type with an airframe weight roughly half as much again as would be achieved by an all-balsa structure—a figure quite acceptable from the flying point of view.

In this case the manufacturers have deliberately set out to produce an all-metal airframe avoiding bonding, riveting and any form of skilled work for assembly. Apart from its obvious interest as something new and quite different from ordinary constructional techniques, this commercial design has proved that the weight question is not a barrier to the more widespread adoption of metals for model airframe work and has provided food for thought as to how best such developments can be utilised.

The particular advantages of metals are high strength, consistency and general robustness, compared with woods. Apart from weight, their main disadvantage is the difficulty of working them to the form required, and in joining them. The latter is probably more of an imagined than a real problem. Modern developments in the technique of joining metals by gluing has led to the introduction of both hot and cold setting resins which produce a metal-to-metal bond comparable in strength with the metal itself, and in most cases superior to riveting or similar forms of mechanical fastening.

The most satisfactory resin of this type available in this country is Araldite, available either in stick form as a heat-curing resin, or in liquid form to be mixed with a hardener for either hot or cold setting. Highest bond strengths are achieved by heat curing and the temperatures involved (140 to 240 degrees C.) are quite moderate so that even mixed metal-wood assemblies can be cured in the family cooker. The cold setting type gives a satisfactory joint strength for most purposes and can be used in a similar manner to any of the other modern cold setting synthetic resin adhesives.

Fabrication of individual components in metal still represents a considerable barrier to the average modeller, however. Without previous experience in metal working, it is unlikely that the amateur would achieve a great deal of success trying to form longeron sections from strip metal, whilst accurate dies are needed for pressing out ribs with stiffening flanges necessary to give them rigidity. Almost certainly, therefore, the amateur-built metal or mixed metal and wood airframe will have to wait on the appearance of suitable commercial stock shapes and components which can be incorporated within "own design" outlines.

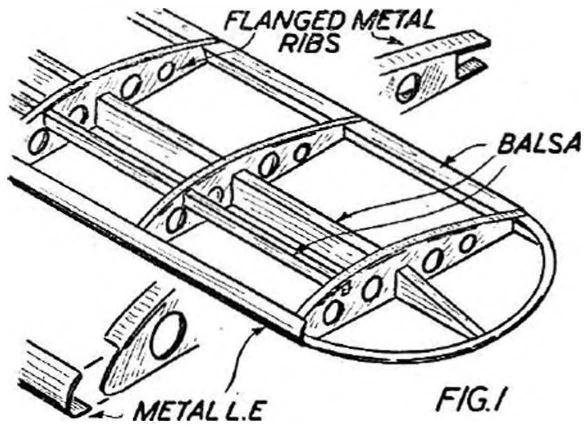


FIG. 1

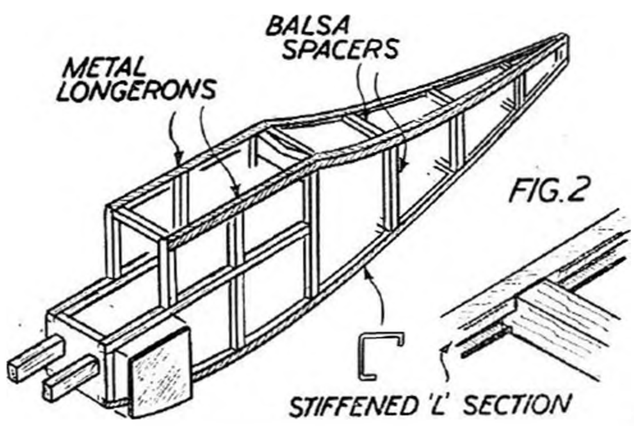


FIG. 2

The main possibilities at the moment would appear to be the utilisation of formed metal ribs and longeron sections in sports type free flight models; possibly spacer sections also for fuselage construction but with a fairly high proportion of balsa still retained in the airframe. A "mixed" construction wing which would appear to have considerable possibilities is shown in Fig 1, retaining conventional wood spars and trailing edge and bonded joints throughout. An advantage of metal in a crash landing is that it will bend before it will break and so damage can usually be straightened out without recourse to repair work on the frame.

Fuselage frames with "L" section metal longerons and conventional balsa spacers might also prove an attractive proposition, with further metal strengthening around the nose section—Fig. 2. Again the construction could be bonded with a joint strength higher than that of the balsa components. In both such structures it should be possible to work down to a frame weight not more than 25% greater than conventional all-balsa construction.

The tail unit would seem almost an ideal subject for simple all-metal frames, but this is the one part of the airframe which seldom receives much hard usage and, from the flying point of view, the lighter the tail unit the better. Apart from the sheer novelty angle, therefore, there appears little justification for adopting metals for the tail unit, particularly as a logical choice for outline shapes would be aluminium wire which is soft and readily bent out of shape. From the purely functional point of view the real justification for working metals into the airframe is to improve the strength of those parts most susceptible to damage, and invariably some weight penalty will be incurred, the final answer being based on whether or not this can be afforded.

The radio control model would, at first sight, appear to be a good subject for boosting strength with some metal structural members, but this would introduce problems of possible radio interference at each and every inter-metallic junction in the airframe. To be sure of eliminating such interference, all such metal-to-metal joints would have to be adequately bonded, and possibly even commonly connected. Even the use of metallised paper covering on radio model fuselages and fins can make aerial position critical, without contributing any definite interference.

The use of sheet metal for motor mounts has largely fallen into disfavour. At one time, cantilever metal mounts for screwing directly onto a ply bulkhead were quite common, material thickness normally being 16 s.w.g. Aluminium sheet was often used, even in commercial products, due to the relative ease with which it could be formed, but it is an unsuitable material for the job. It is too readily bent or distorted. A "strong" aluminium alloy is essential for such duties, e.g. dural, which normally requires annealing to soften before bending and must be worked through fairly generous bend radii, otherwise it will tend to crack or develop stress-corrosion cracks during service.

The application of pure aluminuim is very limited. Where a light metal is selected for a stressed member, dural or an equivalent strong alloy is essential. These require softening before bending and forming by heating to the correct annealing temperature and then either allowing to cool in air or quenching in water. The procedure is simple. The sheet material is rubbed over with a coating of ordinary household soap and then heated over a suitable gas flame until the soap turns brown in colour. The sheet is then quenched or left to cool, when it will be found to be quite soft. In this state it can be bent and formed about as easily as pure aluminium, but will gradually age-harden and regain its full strength once more over a period of 24 hours or so.

The use of soap is an excellent "workshop" method of deciding the right temperature for annealing. Excessive heating, especially on thin sections, may damage or crumple the material. Insufficient heating will not produce the required softening and the metal will tend to crack when being bent through angles. In the case of magnesium alloys, these will actually ignite if excessively heated. Prolonged heating is required with thicker sections to produce this, but thin sections, such as wire, will quite readily burst into flame. This is a point to be borne in mind when using an alloy material such as magnuminium which again tends to be brittle when cold and is most readily formed in a hot state. Unlike the hard aluminium alloys, most magnesium alloys are best heated and bent straight away in the flame.

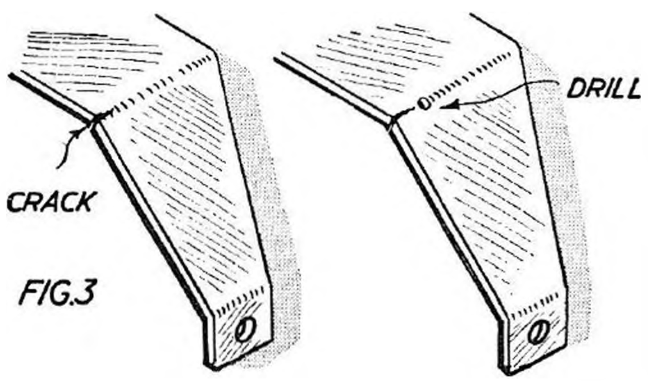


FIG.3

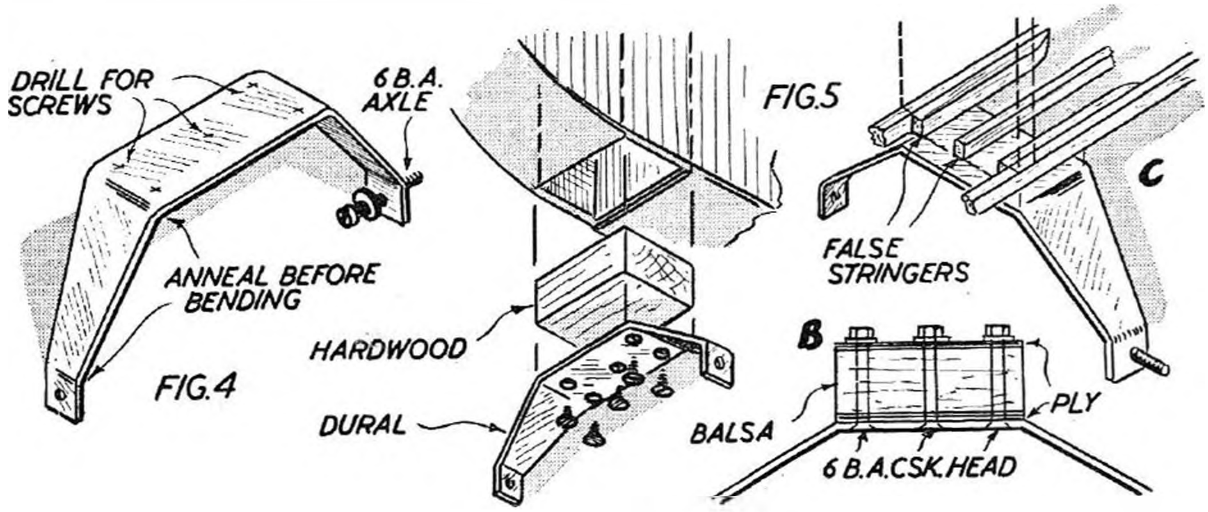
Minimum recommended bend radii for metal sheets is approximately equal to the thickness of the sheet in question. Any smaller radius of bend than that recommended tends to produce cracks which, although not always visible at first, will subsequently develop and eventually cause the part to fail under load. Standard treatment to limit the growth of a crack, should it appear in service and it is inconvenient to replace the part, is to drill a hole through the material just beyond the apparent end of the crack—Fig. 3. Provided this hole is properly located, the crack will develop to it, but not beyond.

Strong aluminium alloy sheet is an excellent material for cantilever undercarriages on semi-scale power models, both free flight and control line types. It was first used on control line team racers and has subsequently been applied with success to radio control and free flight sports models. Such undercarriages are best bent as an integral unit (i.e. not as two separate legs) as shown in Fig. 4, and fastened to the bottom of the fuselage. Various methods of anchorage are possible. The undercarriage can be woodscrewed to a hardwood block which is then cemented into the fuselage, sandwiched between two convenient formers. Alternatively it can be bolted to a substantial balsa block, faced with ply, which again is located by cementing in the fuselage. A simpler method is to screw the unit directly to hardwood (spruce or birch) stringers fixed in the bottom of the fuselage—Fig. 5. Method B is lighter than A, and method C is lighter than B. Where weight saving is important, method C should give entirely satisfactory results, provided the hardwood stringers are themselves firmly anchored in the fuselage.

This type of undercarriage is almost invariably used in a near "scale" position, fitted at the deepest part of the fuselage (and roughly in line with the wing leading edge on conventional designs). This enables the length of leg (and thus the amount of material) to be kept to a minimum—and at the same time also gives the model the best take-off characteristics. On radio control models it can generally be made lighter than an all-wire undercarriage and will be quite robust enough, provided sufficient thickness of material is used—18 s.w.g. minimum for a 2 lb. model, 16 s.w.g. minimum for a 3 lb. model and 3/32 in. sheet for a 4-5 lb. model. These figures apply to a strong aluminium alloy of around 30 ton strength. Softer materials will have to be used in thicker size whilst quite soft material, like aluminium sheet, is quite useless for the job.

More use of metals can be made in control line models, where total weight is not so critical. Complete fuselage bottoms or "pans" for speed models have been cast in magnesium alloy producing an immensely strong, rigid component around which the rest of the model is assembled. There is, however, not enough demand for such components to be produced on a commercial basis on any large scale.

There is no reason, however, why amateur construction should not extend to the making of metal "envelopes" for wings and tail units, secured to a simple hardwood stub spar attached to the fuselage. The required surface is readily developed and cut out of metal sheet of around 22 s.w.g., folded to section about the leading edge and glued along the length of the trailing edge with Araldite. It is possible to produce a very smooth wing in this manner, rigid and light and requiring no subsequent finishing. In this latter respect, at least, it should show a considerable saving in building time over conventional solid balsa or built-up, sheet covered wings. Tail units cut directly from 16 s.w.g. alloy sheet have also proved successful on control line models where the areas are small. The best materials for the production of "envelopes" or slab tails are Alclad or dural. In the thicknesses involved they can be cut with snips and thin sheet shaped by hand bending around a wooden straightedge.



The author with his Cougar, one of the more successful of his second series of ducted fan models.

DUCTED FAN SCALE MODEL AIRCRAFT

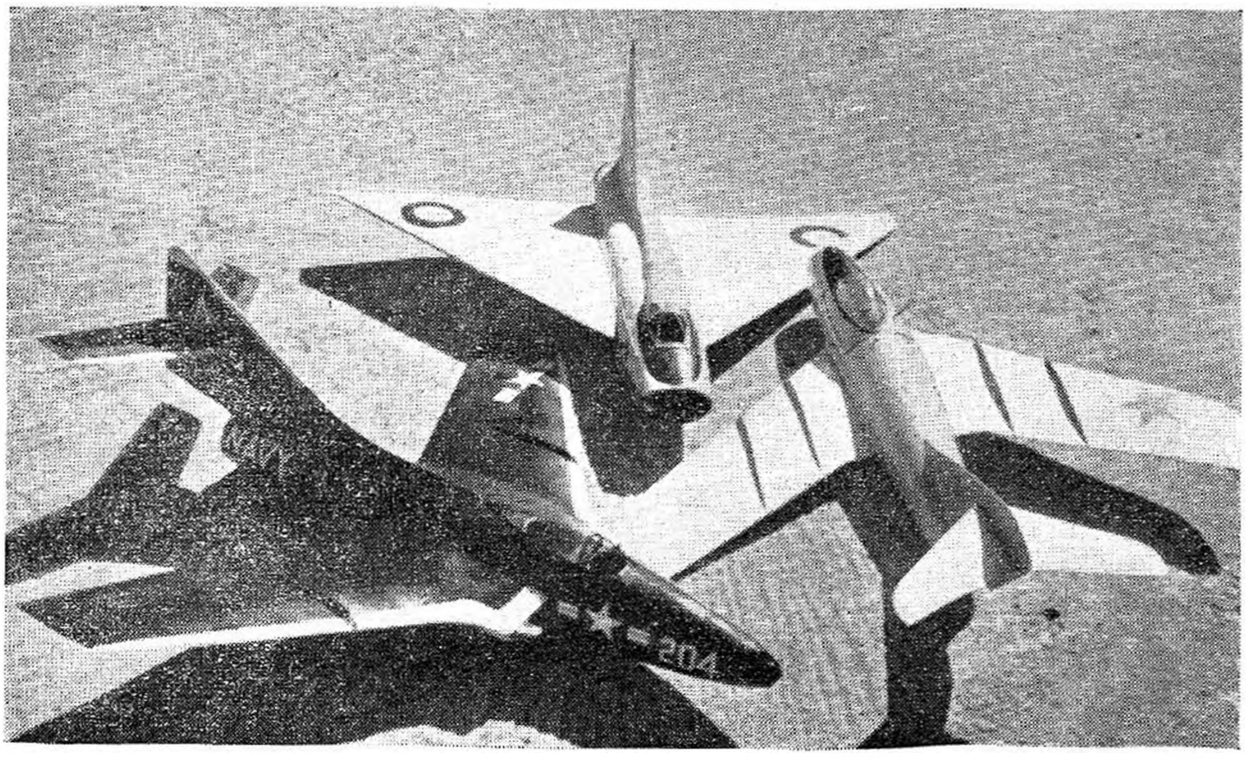
By P. E. NORMAN

HAVING built and flown most of the propeller type of aircraft that I am interested in, I was wondering about the possibilities of producing scale models of the jet-propelled variety and a suitable propulsive unit that would emulate as far as possible the real thing.

I had seen a diagrammatical drawing of the ducted fan system in an American magazine but it was not until I had read an article by Phil Smith of Verons and seen a model of his Lavochin fly by the ducted fan method that I decided here was a good idea for the propulsion and to "have a go".

I felt that the approximate scale, speed and smoothness of modern jet flight would have to be attained and this would call for a much more powerful

Some of the jet fleet: *left to right:* Cougar, Boulton, Paul and Mig 15 (No. 3 in the series.)



motor, larger impeller and again stronger construction that the high speed crashes would call for.

Coupled with this was the realisation that the impeller system would produce considerably less thrust, the engine power remaining the same, than would the normal propeller, quite a considerable problem.

The first thing necessary was to mount a motor with impeller and learn how to start it with the string and pulley method.

This I proceeded to do with an old Elfin 1.8 c.c. motor, making an impeller $4\frac{1}{8}$ in. diameter, from 18 gauge aluminium sheet. I mounted the motor on a suitable mount and gripped it in a vice, having previously run the engine with a propeller to find its starting setting.

After a few attempts and gradually increasing the compression setting, the engine burst into life with a nerve shattering howl, adjustments to the needle valve setting increasing the intensity of the howl and the revs considerably. Then suddenly, even before the first tank full of fuel (a 2 minute limit) was used up, one of the impeller blades sheared off through crystallisation and stuck into a piece of wood directly beneath the vice and the engine ran on vibrating horribly until I managed to close the needle and stop it.

My lesson had been learnt, how to start a motor with cord, and not to use an aluminium impeller. This one, brand new, had not run for 2 minutes before vibration had caused crystallisation and breakage.

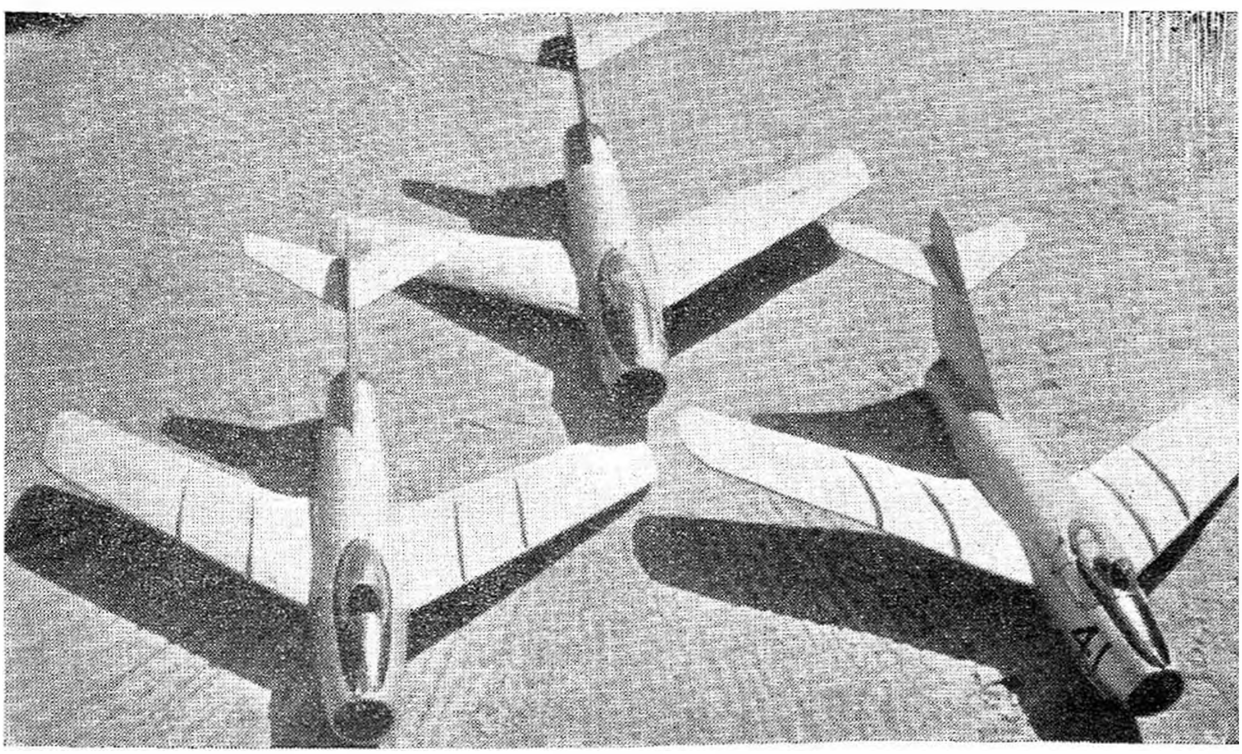
The next thing was a choice of model and I decided on the Mig 15 being a fairly straightforward layout, and having a mid-wing position, which would simplify wing fitting considerably.

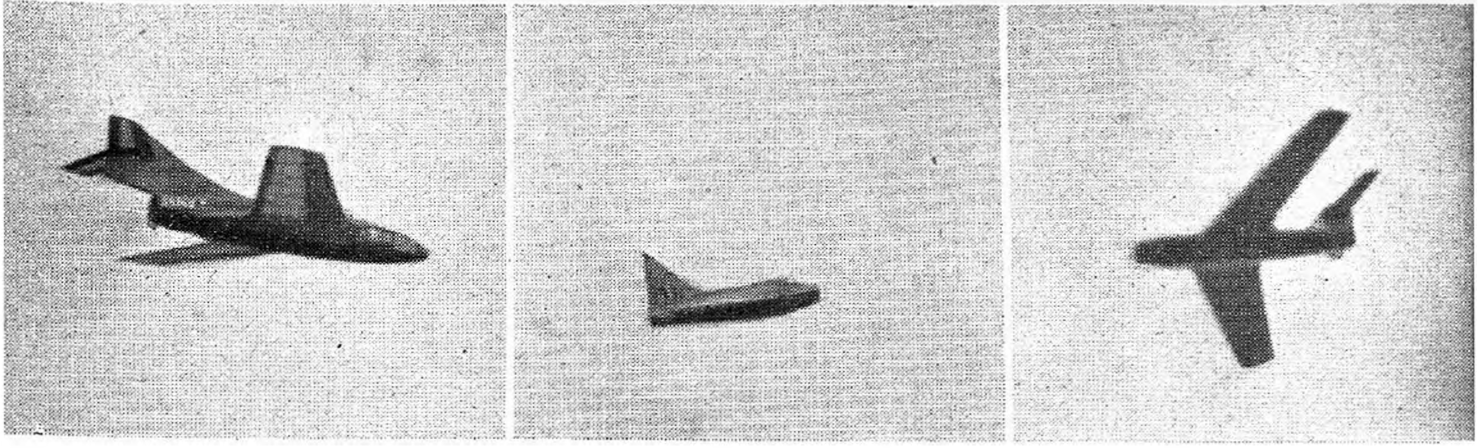
The motor and impeller size were next considered, and allowing for thickness of fuselage construction, a model of about 36 in. span was decided on.

I pondered about the venturi shape of the duct and decided that these refinements could be incorporated later, after I had proved to myself that a model was capable of flight with this capacity engine and impeller diameter.

I decided on a planked type of construction, the fuselage shell thus formed

Three of the Mig 15's, being Nos. 4, 3 and 2 in the series, that on the left having fibreglass fuselage.





Proof of the pudding! Some of the models in flight, *left to right:* Cougar before wings colour doped (photo by P. N. Bragg, London), Boulton Paul 111A and Mig 15 (No. 2 in the series).

being the duct itself. I proceeded to draw up the machine's fuselage to the size I proposed to make it, allowing the efflux tube to be a little larger as this looked very small "by eye".

Mig No. 1. Fuselage Construction

This was constructed in two longitudinal half shells, divided horizontally on the centre line.

Half formers measured at distance of about every 5 inches of length were cut in $\frac{1}{8}$ in. balsa, allowing a $\frac{1}{8}$ in. margin on the circumferences to allow for the thickness of planking to be used. These formers were then cemented base downwards onto a board on which was drawn the plan of the fuselage, with the formers in their correct position. The edges of them were covered with narrow strips of greaseproof paper. Half-inch strips of light balsa were then cut from the $\frac{1}{8}$ in. sheet.

A centre strip was then pinned along the top of the formers. Successive strips were cemented and pinned on each side of the centre one, each strip being carefully tapered towards each end, so that it would fit its neighbour snugly and follow the necessary curve of the fuselage form.

Strips were added until the half shell was completed and allowed to dry, then pins removed and sandpapered smooth and even. When completed, it was lifted off the formers, the inside sandpapered, then the next half built up in the same way. They were then thoroughly doped inside with three coats of dope, thin tissue doped on, and again redoped and put aside to dry, with one or two of the wider formers slipped in place to prevent the dope pulling in the curvature too much.

Engine Mounting

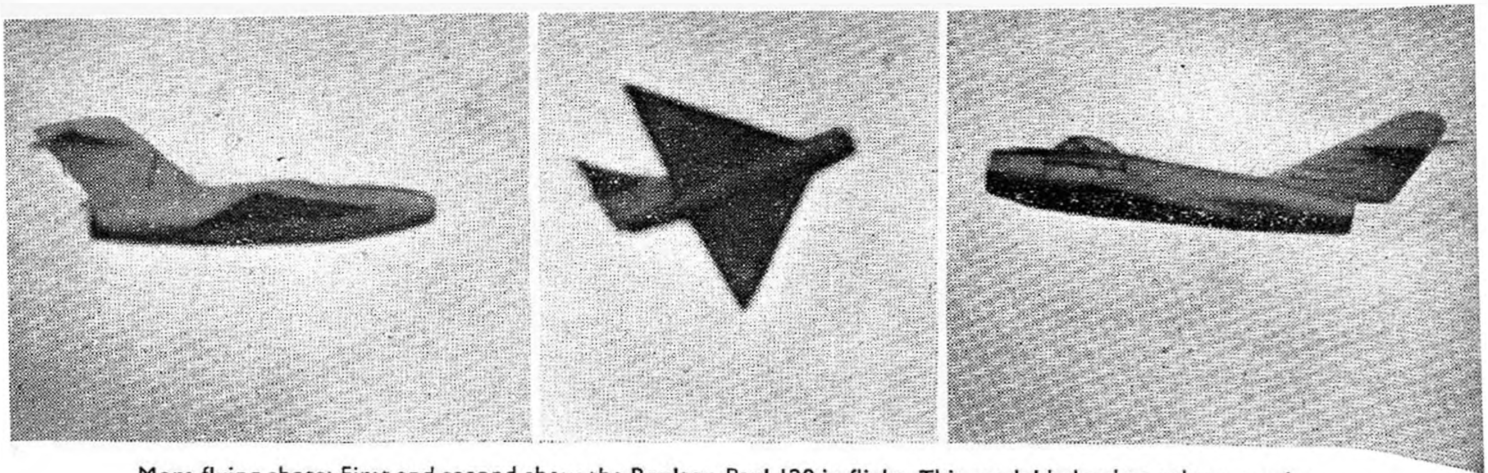
The engine mounting and wing tongues were made in one piece of plywood, passing through both sides of the fuselage. Good quality $\frac{1}{8}$ in. ply was chosen. The extended screwed rods which carry the engine were made form thick auto-cycle spokes, cut and tapped 6 B.A. with 6 B.A. nuts threaded on.

The streamlined cone at the back of the engine was made from two halves of balsa wood, cut and hollowed out, glued on and thoroughly doped.

The Wings. Thinned Clark Y Section.

The wing construction follows standard practice, the only main modification on models after the first one is the addition of a centre reed cane leading edge on front of the balsa and provision of clips to hold the wings in position and the use of a built-up trailing edge. They are built in the usual way over the plan or drawing of the wing with $\frac{1}{16}$ in. balsa ribs $\frac{1}{8}$ in. centre ribs, $\frac{3}{16}$ in. x $\frac{1}{4}$ in. hard balsa leading edges, and 1 in. wide trailing edges cut form $\frac{3}{16}$ in. balsa and sanded off to knife edge. The tips are laminated strips or cut from $\frac{1}{8}$ in. sheet.

The main spars are cut from $\frac{1}{8}$ in. or $\frac{3}{32}$ in. sheet balsa placed on edge,



More flying shots: First and second show the Boulton Paul 120 in flight. This model helped to solve a number of early problems. Right is the fibreglass fuselaged Mig 15 (No. 4 in the series).

and half slotted onto the half slotted ribs. Top and bottom of main spar is then strengthened with $\frac{1}{16}$ in. x $\frac{1}{4}$ in. strips forming a I section girder.

Wing boxes are cut from $\frac{1}{8}$ in. balsa and the space between the walls from $\frac{1}{8}$ in. balsa or equivalent thickness to ply used for tongues. The complete box is wrapped with silk thread. The leading edges back on far and glued and the mainspar are covered with sanded $\frac{1}{32}$ in. sheet (top only).

The wing is covered with thin parachute silk, and doped two coats clear one of colour.

The tail and fin units on my first two Mig 15s were made completely detachable as one unit, held onto its seating by elastic bands, over the leading edge of the fin and to twin hooks of piano wire on the seating.

Rubber dowels (motor car wind screen wiper pins) pass through holes in the bottom of the fin, here reinforced with celluloid, and the angle of incidence of the tail being made adjustable with packing under the back edge of the fin platform. This system has since been altered as it was not found rigid enough and also looked rather untidy.

A small trim tab in aluminium is inserted in the fin trailing edge for all adjustment for trim in left or right turns.

These tail and fin units in the first two Migs were covered with thin tissue but now silk is used throughout being much stronger and only very slightly heavier.

The access hatch to the motor and starting is hinged on the left side looking toward the nose, and the other side is fastened with a spring loaded clip.

The cockpit canopies are moulded from celluloid or acetate sheet, over a wooden male mould, pushed through a plywood piece into which the plan shape of the canopy is cut, and the sheet pinned over this space, while it is being heated and pressed.

The motor and an impeller were put in position on the mount and the two halves of the fuselage, lightly strapped with elastic bands, in position on top and bottom of the platform, and the complete lashup tried for balance.

Having no experience of swept wing machines, I was rather in the dark as to where the correct c/g should be, but estimated that it should be about halfway of centre chord, (this was not far out, being slightly too far back in actual practice) and I was delighted when the lashup appeared to balance at just about this point.

Allowing for the nose strengthening, gun blisters, and completed doping and covering of completed fuselage, it seemed about right and the wings were in their correct position in relation to the fuselage, so the next stage of fitting the engine mount and glueing up was tackled.

Strips of $\frac{1}{8}$ in. by $\frac{1}{4}$ in. balsa were cemented along the edge of one half shell so that half their width, i.e., $\frac{1}{8}$ in. projected along each side. Gaps were cut at the positions for the engine mount and wing tongue pieces.

The positions of the impeller was noted and a strip of paper bent in each half shell to give the internal circumference at this point.

A 1 in. wide ring of $\frac{1}{32}$ in. plywood was made exactly to this diameter.

Another circle of $\frac{1}{8}$ in. plywood is then cut to fit exactly inside this ring and this circle centrally drilled and rmounted on the engine shaft in place of the impeller.

This idea ensures that the engine will be exactly located in its right place in the fuselage shells.

The ring is now securely cemented in position in the lower half of the fuselage and the engine mount cemented in the gaps provided for it.

The second half of the shell is now held in its correct position and the location of the engine ring, etc., noted with pencil marks so that the hatch can be marked and cut appropriately, after the two halves are cemented together.

Cement was now run along the two projecting strips and the second half of the fuselage brought into position and cemented being held in position by a number of elastic bands stretched over the two pieces throughout its length.

When dry, the fuselage was completely sand-papered externally, and doped with two or three coats of dope, then covered with light tissue and doped again.

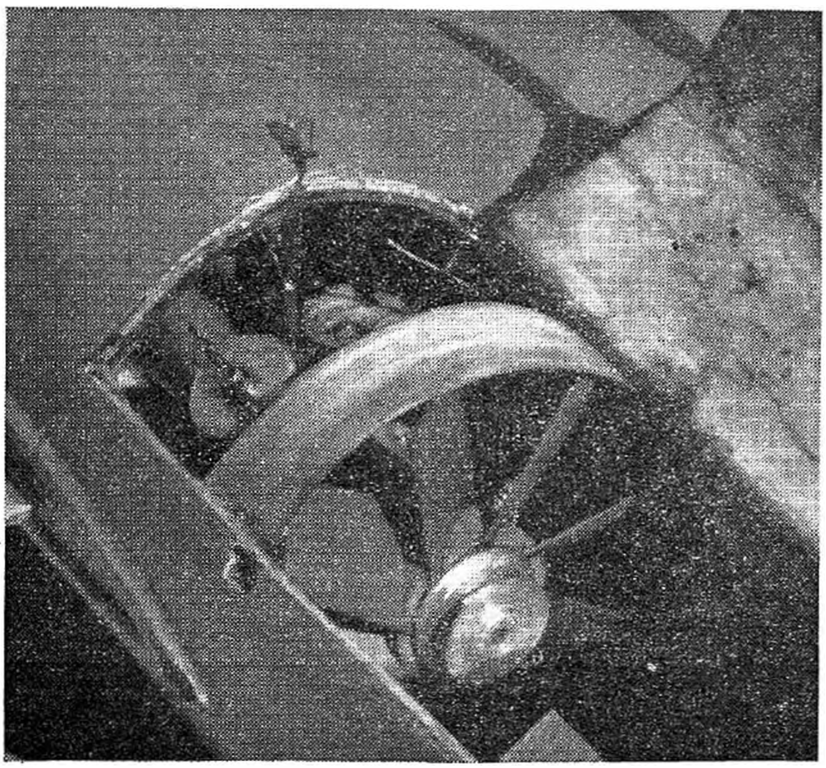
The front of the nose was strengthened with a ring of cane bent to the correct diameter, bound and glued, and pinned and glued in position on front of the fuselage, then sanded carefully to follow nose contours.

The plywood disc removed, and impeller made and fitted in position.

Fuel tank was made from a portion of transparent tootbrush case, cut to size, fresh top cemented on and placed in position on engine platform, with filler tube (plastic projecting through small hole in fuselage back immediately behind hatch).

The second Mig 15 was built to replace the original which was, unfortunately destroyed when a car ran over it.

This was almost identical to the first, but an ounce or two was squeezed off the weight and the model had a better performance. New impeller designs were tried and proved more successful than the twisted type, although correct balance was more difficult to attain.



Installation of engine and impeller in Mig 15

The problem of oil soakage began to make itself apparent in the new model, as its total weight has now reached 29 ounces, its original weight being just about 24.

The next venture was a model of the Boulton Paul P. 120 delta wing machine with tail. This seemed to have good possibilities—generous wing area, large cross-sectional area fuselage, intake, and efflux. The same system of fuselage construction was employed, also the wings and tail unit.

An Elfin 2.49 c.c. Radial mount engine was installed after a 1½ c.c. motor proved underpowered, and after some adjustment to the c/g position and tail incidence, good flying was achieved, the machine being fast. The glide was troublesome, but later cured.

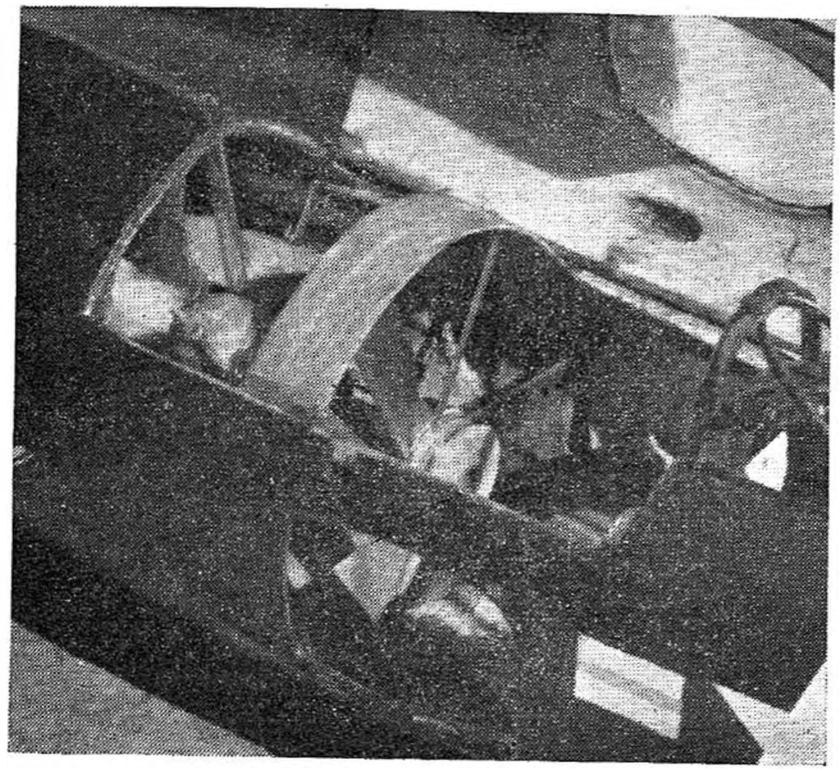
Engine vibration troubles were experienced, and a new improvement in mounting was introduced on subsequent models.

The Hawker P. 1081, fore-runner to the Hawker Hunter, was next on the list, span being decided at 40 in. as this was the first model to have wing root intakes and an E.D. 2.46 racer was the power unit employed turning a 5½ in. impeller.

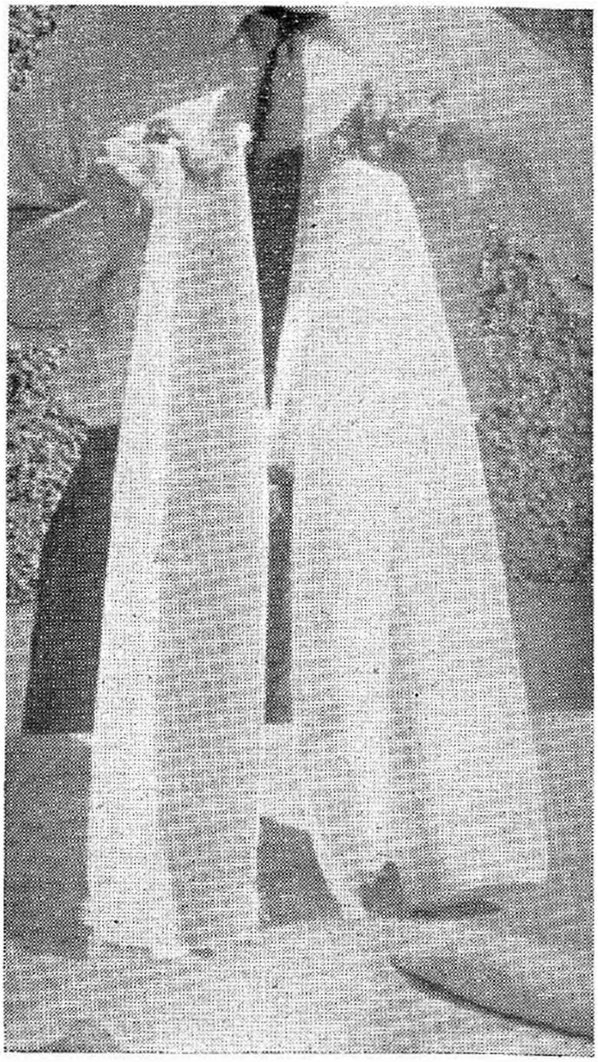
The wing root installation meant placing the engine further back than usual, and this resulted in tail heaviness which was cured by the addition of some weight to the nose, but the all-up weight of the model came out at 39 ounces and although it would fly level and fast, it would not climb and eventually further efforts were abandoned.

The problem of weight/engine power ratio was becoming very evident and I decided to work again rather on the lines of the Mig, and built the Mystere II to a wing span of 31½ in., planked fuselage construction and final all-up weight 19 ounces, with Elfin 1.8 c.c. motor.

The Mystere II has a rather small nose intake, and this was augmented by cutting the front of the cockpit cover away and introducing a hole in the hatch beneath the cover, and also a slit in the underside of the nose about ¾ in. wide × 3½ in. long. These extra air intakes gave sufficient air for the motor to give its revs. when the hatch was closed after starting the motor. Although the Mystere II is a low wing machine the model showed a tendency to stall, and so an extra efflux area was cut and shrouded in such a way that part of the ejecting air was deflected downwards through the extra air hole, thus giving a down thrust action to the nose.



Motor and impeller as fitted to the Cougar



Fibreglass fuselage shells, intended in this case for a new version of the Boulton Paul P.111A.

This idea completely cured the stalling tendency, and I have used it on later models.

There followed a Hunter (later altered and made into a Cougar) using a centrifugal type impeller. Level flight was achieved with each model, but little climb due to overweight, and these experiments were shelved.

The Boulton Paul P.111A Delta machine attracted me, and in view of the experience I had gained with the P. 120, I decided to build it, using a different form of fuselage construction, this is the moulded sheet balsa type made in four separate pieces over a half mould. The pieces are then glued together in pairs, internally covered and reinforced where necessary, engine mount, impeller ring, etc., added and then the two halves joined as previously. This type of construction is considerably lighter and since there are less glue joints there is less likelihood of joints cracking and becoming oil soaked. Thinner balsa sheet may be used (in this model $\frac{1}{16}$ in. and eventually I have used $\frac{1}{32}$ in.) and a very smooth surface results.

For external covering after sanding, I hit upon the idea of using a fine nylon stocking (one of my wife's throw-outs). This was carefully stretched over the fuselage and over the tongues, ensuring that the foot was at the nose end. Razor blade cuts were made at the wing tongue positions, and the stocking pulled at both foot and top ends and bound. The nylon fits the shape beautifully. It is then thoroughly doped to secure it in position, and finally the ends trimmed off. It is about the simplest way that I have discovered to cover a jet model fuselage. The nylon is covered with large panels of light-weight tissue doped on to give a really smooth surface over the nylon stocking.

The spin behind the cockpit and fin seating were carved from light balsa, hollowed out, and securely cemented in position. The position for the hatch had been marked as before, and was then cut and hinged and the clip fitting added.

No stall tendency was experienced with this model, in spite of the fact that no down thrust air hole was incorporated.

A reflexed trailing edge was incorporated in the wings, the outer portions of which have slight adjustment for longitudinal trim. Provision was also made to include pendulum rudder, should this seem necessary, but the stability of the delta showed that this was not needed.

This model is fitted with the 2.49 c.c. Elfin and is very fast and has a good rate of climb.

Cougar

A span of 36 ins. was decided upon, and the fuselage built by the moulded $\frac{1}{16}$ in. balsa sheet method. The nose was carved from two solid pieces and hollowed out, and the region where the intake holes occurred in the fuselage suitably reinforced with cane and hardwood. Fuselage covered similar to P.111A.

Extra air enters through the cockpit canopy front, and gridded area on top of the nose and a number of holes grouped round the nose, similar to gun ports and camera ports. A downthrust air chute is incorporated, the model showing a tendency to stall before this was fitted.

Wings are "knockoffable" right from the fuselage and the fin is fixed.

Tail plane in two halves, clips on to a tongue running through the fin. This tongue is held in position by two 8 B.A. screws, which have a spring on each, thus allowing full adjustment to the tail incidence by means of wedged shape packing pieces. This method of tail fitting is very satisfactory, and is used on both latest Mig 15's.

The Cougar flies well and climbs steadily. It has a very good glide, but its flying speed is somewhat slower than the Boulton Paul.

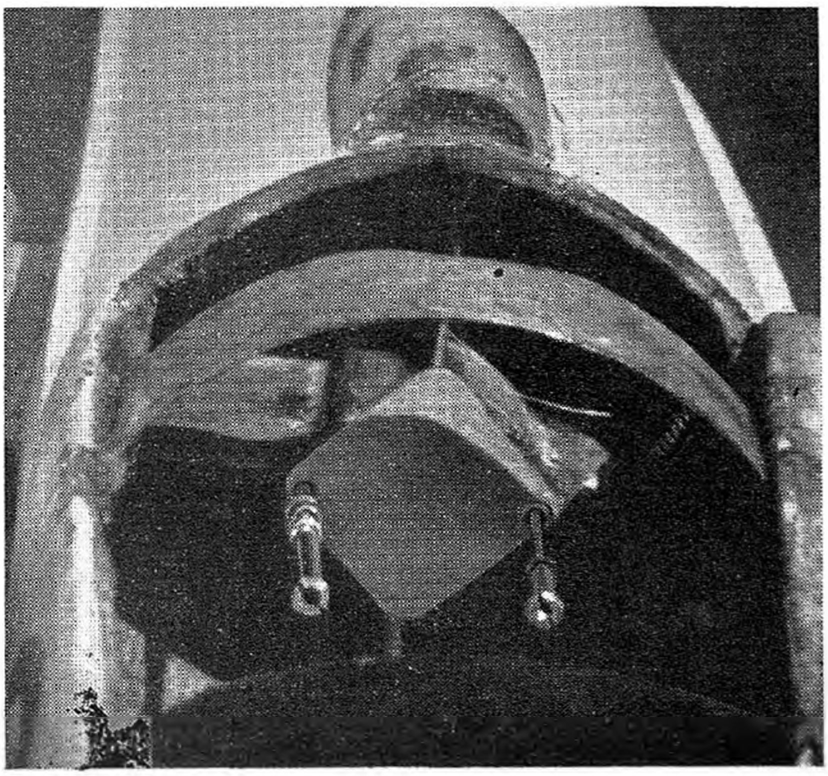
Finally, have followed three more models, a Yak 25, and two Mig 15's. The two Migs, almost identical to each other, are interesting, in that one is made up with the moulded balsa sheet method and the other a moulded fibre glass fuselage (made on the same mould). The weights of the two models are almost identical, the fibre glass possessing much more strength and I think is considerably easier to make and at last the old problem of oil soakage has been solved.

I am at present building another fibre glass fuselage for the Boulton Paul P.111A, and these halves may be seen in the photo.

The little Yak 25 machine, an unusual design—having an extremely short fuselage and enormous fin, is powered with an Elfin 1.8 c.c. and when the motor was at its best, produced spectacular climb and manoeuvres in the air.

Directional stability in this machine was extremely tricky, the large fin causing the nose to drop during turns.

This completes a summary of my jet type scale models to date, some successes others failures; there are many problems to be overcome, those which are most evident at present are:—



Close-up of engine mount on the Boulton Paul

The author with his Yak 25

(1) Increase of weight of model due mainly to oil soakage and dirt.
(2) Engine vibration.
(3) Engine wear due to extremely high-speed running, and sucking in dirt, particularly if model touches down or crashes with motor still running.
(4) Surging of fuel and syphoning action over filler tube, this is normally left open so that tank may be replenished while motor is running, as it is extremely thirsty at these high revs.
(5) Adequate air-frame and impeller strength coupled with light construction.

Test Gliding and Flying

The swept wing and delta machine show a marked degree of stability, dihedral angle being unnecessary as the sweep of the wings themselves help to serve this purpose.

The model should be trimmed so that it is very slightly nose heavy, and all gliding tests carried out as usual in calm conditions and if possible over long grass.

Turning may be controlled by small trim tabs, or by slightly bending the trailing edge of the rudder (I make mine from wide material to allow this). Adjustment should be only slight as the models are usually very sensitive.

The swept wing model needs the tail at a fairly marked negative degree. I have tried both cambered, and symmetrical section tails, the latter needing a less negative angle of attack.

Small weights can be added to the nose or tail to help find correct centre of gravity, and if one is able afterwards to move the motor a fraction further forward, by a packing piece of thin plywood between the engine and engine mount (radial type mounting) the weights can be removed.

The glide should be straight and with no tendency to a stall.

Engine Running

I follow a set drill in this operation, which leads to easy and almost constant starting once the motor is warm.

Before installing the engine in the model, rig it up with impeller on bench test, and start and run it and note very carefully the setting of the contra screw lever, and number of turns of needle valve. When motor is installed in model, ensure that the settings are correct.

Operation

1. Wind starting cord three or four turns round pulley or nut.
2. Fill tank with fuel.
3. Open needle valve a fraction till fuel starts to drip from air intake.

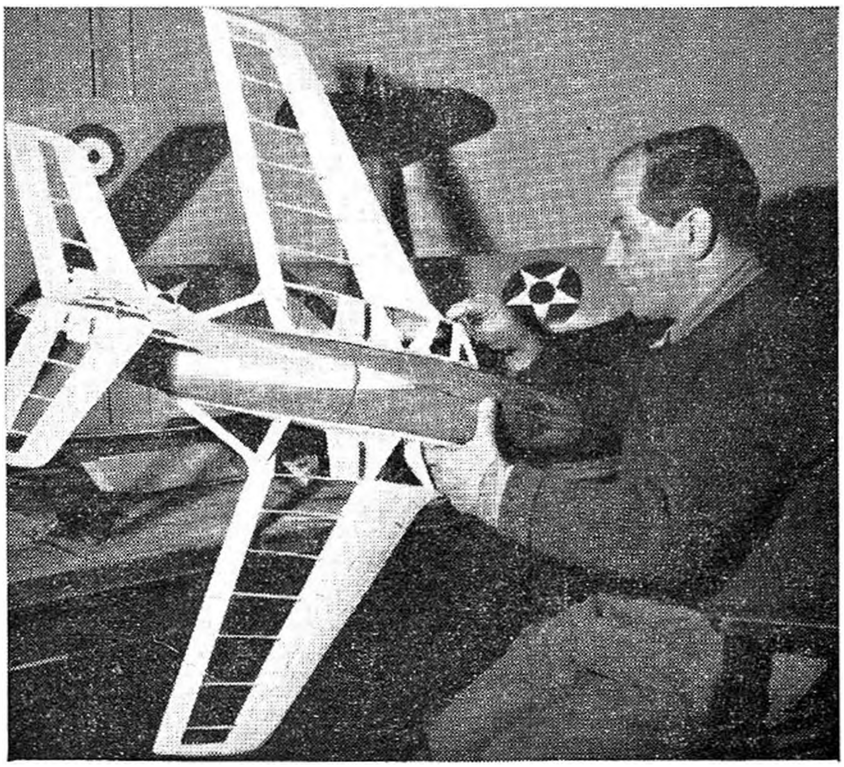
4. Slacken off contra screw about $\frac{1}{8}$ turn.
5. Pull starting cord sharply gripping head of cylinder with other hand.
6. Repeat operation two or three times. Motor should start, if it does not:—
7. Open needle valve fraction further, increase compression a little bit, pull cord again. If motor does not start:—
8. Close needle valve, reduce compression to original setting and turn impeller till piston has closed exhaust port.
9. Squirt a drop of fuel through exhaust port against piston. (Do not on any account squirt fuel into open exhaust port, as this probably result in broken C/shaft or connecting rod, when cord is pulled).
10. Pull cord and engine should fire a few revs.
11. Open up needle valve to correct setting and repeat operation.
12. When engine is running, adjust valve setting and contra screw setting to maximum revs.
13. Top up fuel tank, close hatch and immediately launch model. If model is held for very long with hatch closed, it will tend to overheat and probably stop.
14. Launch model evenly, and at correct flying speed.
15. Warn spectators of speed of operation, and need to keep a clear launching passage in front.
16. *Do not fly unless insured.*

After flying, make sure that fuel tank is empty and pipe line clear, so that no oil will congeal and cause starting difficulties.

Check occasionally that engine nuts and bolts are tight.

Ensure that needle valve setting and contra screw cannot alter when running. (Spring loading or ratchet fitting are a necessity.)

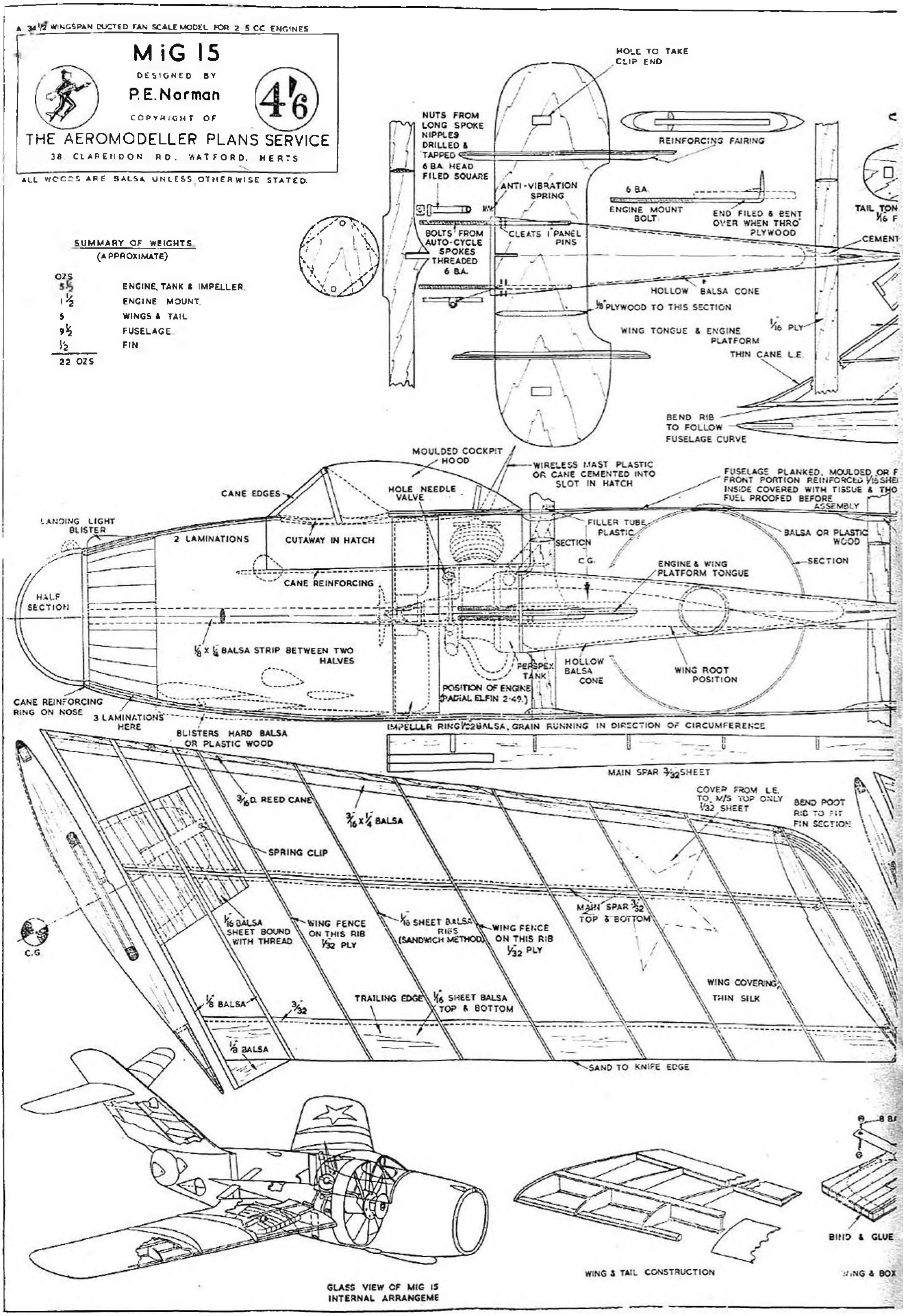
Do not attempt to start or run motor if it has any dirt in it. It is advisable, if possible, to carry a spare
C/shaft connecting rod or gudgeon blade.
Impeller or spare blades
Spare starting cord.
Tube of cement to patch immediately any holes or pricks which may occur.
Spanner to tighten nuts, etc., on crankshaft.

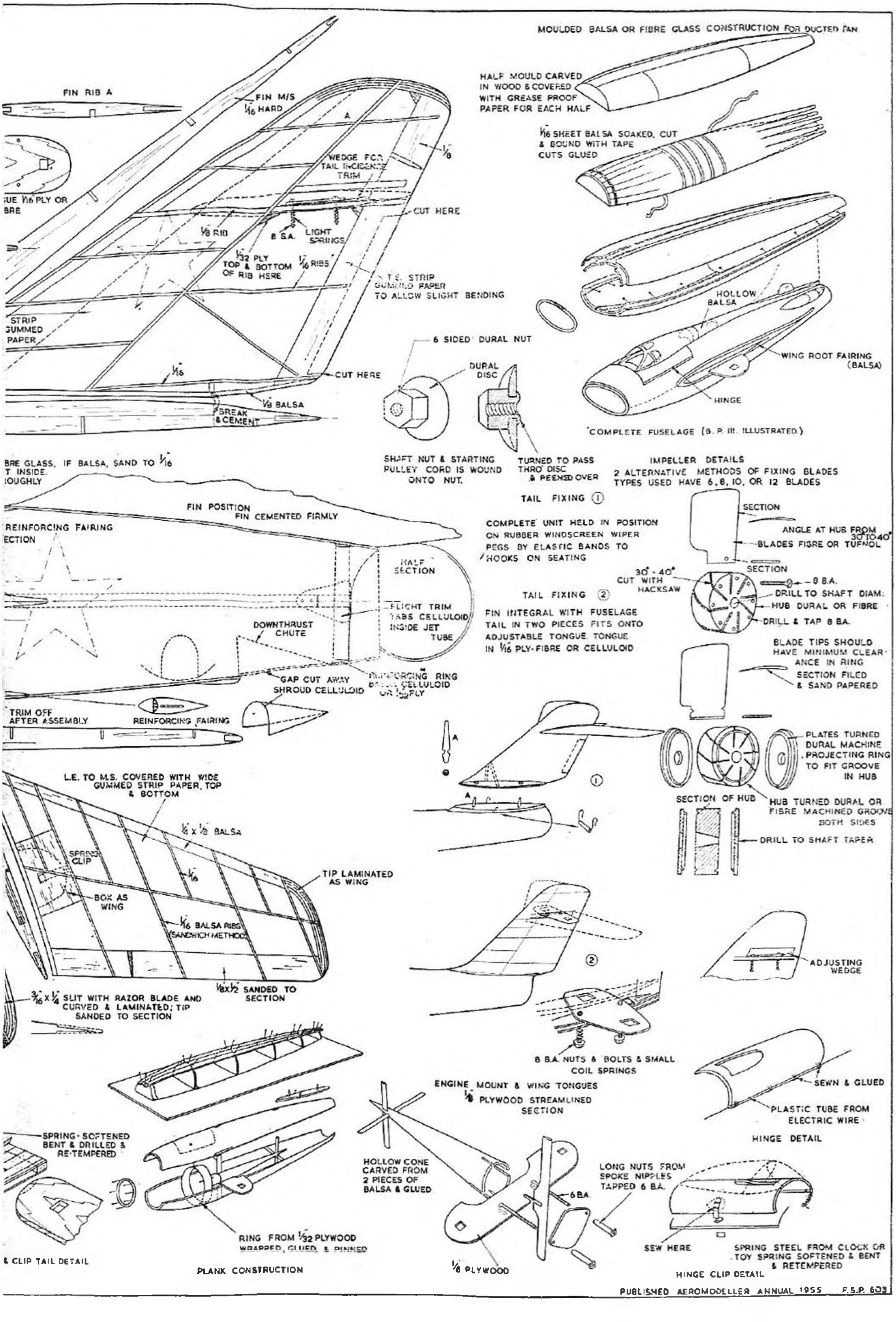


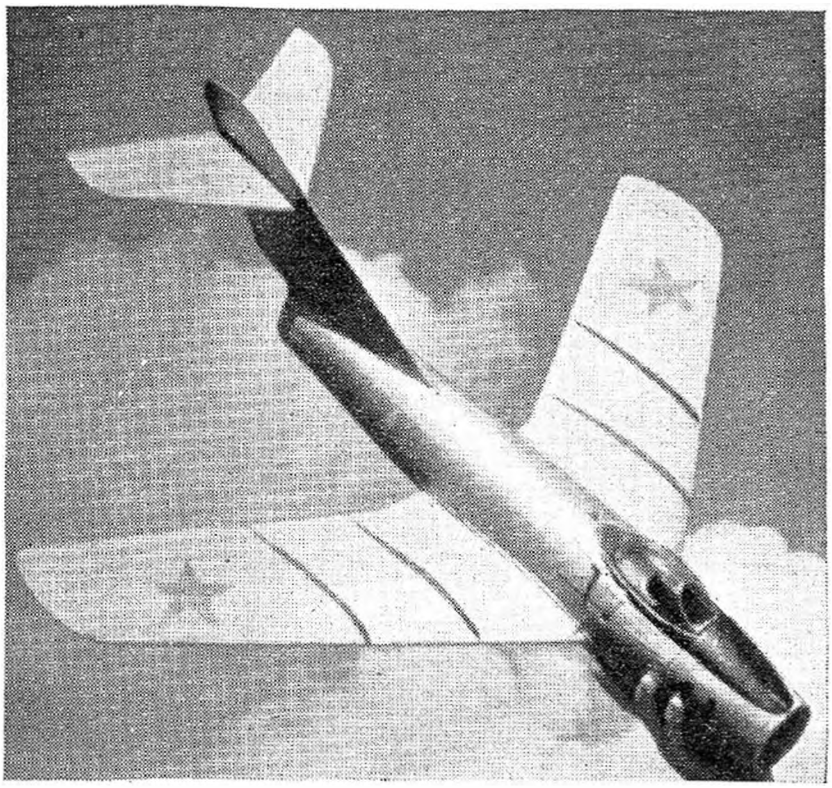
Flying Trimming

High powered ducted fan models have a marked tongue and gyroscopic reaction.

The author at work on the Cougar. (*Keystone Press Picture*)


A 34½" WINGSPAN DUCTED FAN SCALE MODEL FOR 2.5 CC ENGINES
MiG 15
DESIGNED BY
P. E. Norman
COPYRIGHT OF
THE AEROMODELLER PLANS SERVICE
38 CLARENDON RD. WATFORD, HERTS
4/6
ALL WOODS ARE BALSA UNLESS OTHERWISE STATED.
SUMMARY OF WEIGHTS
(APPROXIMATE)
OZS
5½ ENGINE, TANK & IMPELLER.
1½ ENGINE MOUNT.
5 WINGS & TAIL
9½ FUSELAGE
½ FIN
22 OZS
HOLE TO TAKE CLIP END
NUTS FROM LONG SPOKE NIPPLES DRILLED & TAPPED
6 BA HEAD FILED SQUARE
ANTI-VIBRATION SPRING
BOLTS FROM AUTO-CYCLE SPOKES THREADED 6 BA.
CLEATS 1" PANEL PINS
REINFORCING FAIRING
6 BA ENGINE MOUNT BOLT
END FILED & BENT OVER WHEN THRO' PLYWOOD
HOLLOW BALSA CONE
1/8 PLYWOOD TO THIS SECTION
WING TONGUE & ENGINE PLATFORM
1/16 PLY
THIN CANE L.E.
BEND RIB TO FOLLOW FUSELAGE CURVE
TAIL
CEMENT
MOULDED COCKPIT HOOD
WIRELESS MAST PLASTIC OR CANE CEMENTED INTO SLOT IN HATCH
CANE EDGES
HOLE NEEDLE VALVE
FUSELAGE PLANKED, MOULDED OR FRONT PORTION REINFORCED 1/16 SHEET INSIDE COVERED WITH TISSUE & THO FUEL PROOFED BEFORE ASSEMBLY
LANDING LIGHT BLISTER
2 LAMINATIONS
CUTAWAY IN HATCH
FILLER TUBE PLASTIC
SECTION
C.G.
BALSA OR PLASTIC WOOD
ENGINE & WING PLATFORM TONGUE
CANE REINFORCING
HALF SECTION
1/8 x 1/4 BALSA STRIP BETWEEN TWO HALVES
PERSPEX TANK
HOLLOW BALSA CONE
WING ROOT POSITION
POSITION OF ENGINE (RADIAL ELFIN 2.49.)
CANE REINFORCING RING ON NOSE
3 LAMINATIONS HERE
BLISTERS HARD BALSA OR PLASTIC WOOD
IMPELLER RING 1/32 BALSA, GRAIN RUNNING IN DIRECTION OF CIRCUMFERENCE
MAIN SPAR 3/32 SHEET
3/16 D. REED CANE
3/16 x 1/4 BALSA
COVER FROM L.E. TO M/S TOP ONLY 1/32 SHEET
BEND ROOT RIB TO FIT FIN SECTION
SPRING CLIP
MAIN SPAR 3/32 TOP & BOTTOM
1/16 BALSA SHEET BOUND WITH THREAD
WING FENCE ON THIS RIB 1/32 PLY
1/16 SHEET BALSA RIBS (SANDWICH METHOD)
C.G.
WING COVERING THIN SILK
1/8 BALSA
3/32
TRAILING EDGE
1/16 SHEET BALSA TOP & BOTTOM
SAND TO KNIFE EDGE
GLASS VIEW OF MIG 15 INTERNAL ARRANGEME
WING & TAIL CONSTRUCTION
BIND & GLUE
WING & BOX


MOULDED BALSA OR FIBRE GLASS CONSTRUCTION FOR DUCTED FAN
HALF MOULD CARVED IN WOOD & COVERED WITH GREASE PROOF PAPER FOR EACH HALF
1/16 SHEET BALSA SOAKED, CUT & BOUND WITH TAPE CUTS GLUED
HOLLOW BALSA
WING ROOT FAIRING (BALSA)
HINGE
COMPLETE FUSELAGE (B. P. III. ILLUSTRATED)
FIN RIB A
FIN M/S 1/16 HARD
WEDGE FOR TAIL INCIDENCE TRIM
CUT HERE
1/8 RIB
8 B.A.
LIGHT SPRINGS
1/32 PLY TOP & BOTTOM OF RIB HERE
1/16 RIBS
GUMMED PAPER TO ALLOW SLIGHT BENDING
STRIP GUMMED PAPER
1/8 BALSA
BREAK & CEMENT
6 SIDED DURAL NUT
DURAL DISC
SHAFT NUT & STARTING PULLEY CORD IS WOUND ONTO NUT.
TURNED TO PASS THRO' DISC & PEENED OVER
IMPELLER DETAILS
2 ALTERNATIVE METHODS OF FIXING BLADES
TYPES USED HAVE 6, 8, 10, OR 12 BLADES
TAIL FIXING (1)
COMPLETE UNIT HELD IN POSITION ON RUBBER WINDSCREEN WIPER PEGS BY ELASTIC BANDS TO HOOKS ON SEATING
TAIL FIXING (2)
FIN INTEGRAL WITH FUSELAGE TAIL IN TWO PIECES FITS ONTO ADJUSTABLE TONGUE. TONGUE IN 1/16 PLY-FIBRE OR CELLULOID
SECTION
ANGLE AT HUB FROM 30° TO 40°
BLADES FIBRE OR TUFNOL
30°-40° CUT WITH HACKSAW
8 B.A.
DRILL TO SHAFT DIAM.
HUB DURAL OR FIBRE
DRILL & TAP 8 BA.
BLADE TIPS SHOULD HAVE MINIMUM CLEARANCE IN RING
SECTION FILED & SAND PAPERED
PLATES TURNED DURAL MACHINE PROJECTING RING TO FIT GROOVE IN HUB
SECTION OF HUB
HUB TURNED DURAL OR FIBRE MACHINED GROOVE BOTH SIDES
DRILL TO SHAFT TAPER
FIN POSITION
FIN CEMENTED FIRMLY
REINFORCING FAIRING
HALF SECTION
FLIGHT TRIM TABS CELLULOID INSIDE JET TUBE
DOWNTHRUST CHUTE
GAP CUT AWAY SHROUD CELLULOID
TRIM OFF AFTER ASSEMBLY
REINFORCING FAIRING
L.E. TO M.S. COVERED WITH WIDE GUMMED STRIP PAPER, TOP & BOTTOM
1/4 x 1/8 BALSA
SPRING CLIP
TIP LAMINATED AS WING
BOX AS WING
1/16 BALSA RIBS (SANDWICH METHOD)
1/8 x 1/2 SANDED TO SECTION
3/16 x 1/4 SLIT WITH RAZOR BLADE AND CURVED & LAMINATED; TIP SANDED TO SECTION
ADJUSTING WEDGE
8 B.A. NUTS & BOLTS & SMALL COIL SPRINGS
ENGINE MOUNT & WING TONGUES 1/8 PLYWOOD STREAMLINED SECTION
SEWN & GLUED
PLASTIC TUBE FROM ELECTRIC WIRE
HINGE DETAIL
SPRING-SOFTENED BENT & DRILLED & RE-TEMPERED
HOLLOW CONE CARVED FROM 2 PIECES OF BALSA & GLUED
LONG NUTS FROM SPOKE NIPPLES TAPPED 6 BA.
6 BA.
RING FROM 1/32 PLYWOOD WRAPPED, GLUED, & PINNED
CLIP TAIL DETAIL
PLANK CONSTRUCTION
1/8 PLYWOOD
SEW HERE
SPRING STEEL FROM CLOCK OR TOY SPRING SOFTENED & BENT & RETEMPERED
HINGE CLIP DETAIL
PUBLISHED AEROMODELLER ANNUAL 1955 F.S.P. 603



Close-up of the third Mig 15 to be built

It is best to let model fly to left on torque turn, although right turns can be achieved equally successfully.

Should turns in either left or right direction be too tight, it is best to trim on a small flap fastened on left or right inside the extreme end of the tail pipe. I usually make mine in celluloid, and these can be slightly bent to trim.

Should the model turn too sharply to the left, bend the left tab inwards a fraction to deflect the blast slightly to right, and the opposite side tab should the model turn too much to the right.

If model tends to stall, increase weight slightly on nose, or increase incidence on tail.

Flying Scale Model Mig 15

Powered with either Elfin 1.8 or 2.49 c.c. radial mount motor

The Fuselage. Choose the type of construction. If *planked*, cut half formers, cement to building board, cover edges with grease-proof paper and construct as per instructions, making two halves.

Moulded Construction—carved mould (half fuselage shape). Cover with greaseproof paper. Wet balsa sheet in hot water, cut slits at both ends (see sketch) and bind onto mould with tape or elastic. Make two pieces for each half (top and bottom). When dry cement. Add similar reinforcing pieces to inside of front section of fuselage, back as far as engine mount. Cement securely into outer shells.

Fibre Glass—carve and cover mould as above. Add coarse scrim (fibre glass) and resin and hardener. Allow to set, and add fine mesh fibre glass—paint over with resin and hardener again. When dry remove shell and lightly sandpaper inside to remove greaseproof paper. Add one or two additional layers to the nose end and reinforcing pieces at engine mount points (see sketches). Sandpaper edges of each half to make good fit to each other.

Engine Mount and Wing Tongue. Cut from good quality one eighth inch plywood. Cut the vertical member and front piece from $\frac{1}{16}$ in. and $\frac{3}{32}$ in. plywood.

The engine bolts are made from thick Auto Cycle spokes, cut and tapped 6 BA thread. The other ends are filed and bent. Holes are now drilled through the $\frac{1}{8}$ in. ply, the bent ends of bolts inserted and hammered over securely. The front ends of the bolts are held firmly by the little saddle pieces, made from

1 in. panel pins, bent into U, heads removed after passing through plywood on each side of bolts bent over; the position of the bolts should be found by measuring the position of the holding down holes equally on both sides of the centre line.

The Fuel Tank on my Mig is cut from a piece of $\frac{3}{8}$ in. thick perspex, to the same shape as the rear of the engine.

The inside is then turned to as large a diameter as possible allowing an end thickness of about $\frac{1}{16}$ in. Bolt holes are then drilled through perspex and also filler tube hole and hole drilled and tapped 4 or 6 BA to take threaded tube for fuel line to engine.

Impeller Ring. This is made from $\frac{1}{32}$ in. plywood bent with grain running in direction of circumference.

True circumference length is found by measuring inside half circumferences of shells with lengths of paper, then cutting plywood to this length and allowing enough extra for gluing and pinning.

A disc of plywood to fit snugly inside this ring is then cut and drilled centrally ready for mount and engine fitting.

Fin and Tail. Make and fit fin as per plans.

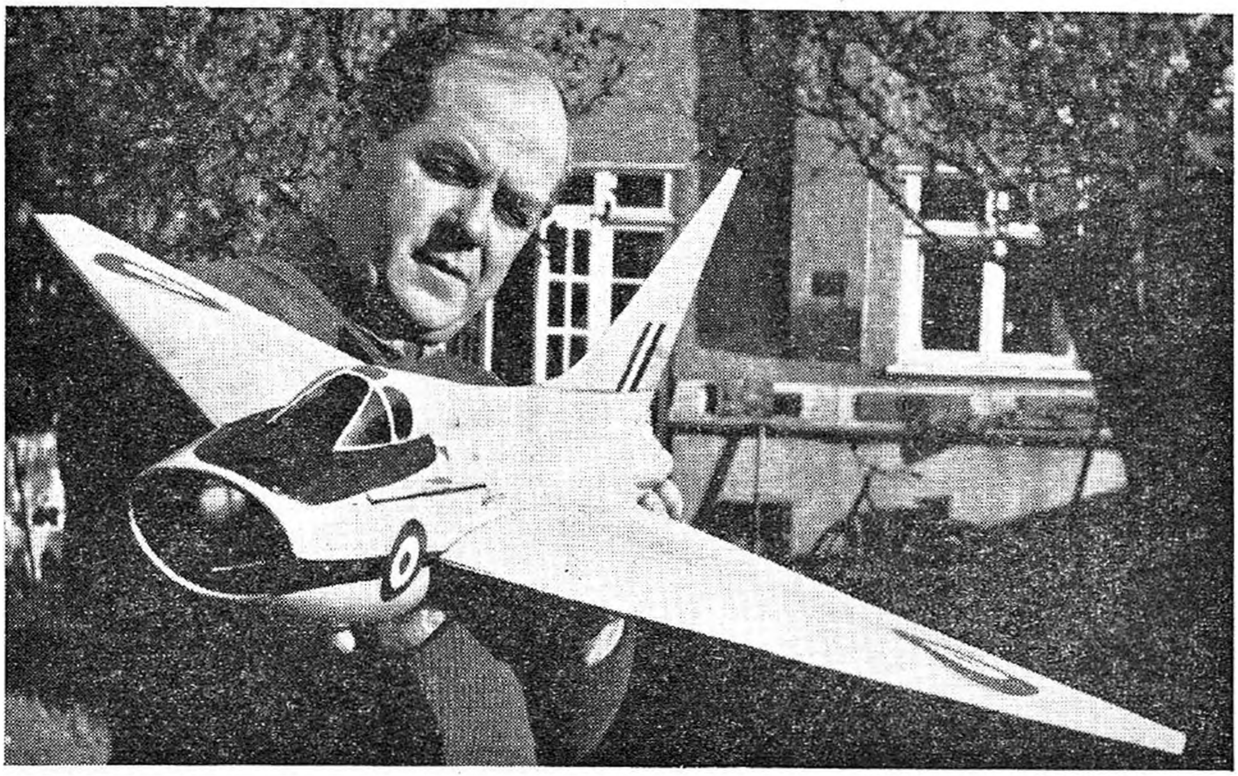
Fit and cement securely into place on fuselage checking that it is dead straight and true to axis of fuselage. Add tail tongue etc., and cover with silk.

Tail. Make tail as instructions and plan. Ensure that boxes fit tongue snugly and that retaining clips hold them securely in position.

Wings. Make boxes and clips and fit carefully to tongues. Construct wings on plan as per instructions.

Cut gaps in root ribs and carefully fit and glue boxes in position, ensuring that the right angles of incidence are achieved (see plans). Add $\frac{1}{32}$ in. sheet leading edge covering and finally cover wings with silk. Two or three coats of clear dope, and pin down during drying.

The author poses with his Boulton Paul 111A. (*Keystone Press Picture*)



SINGLE SEATERS

Above, **AMERICAN** design of the late twenties, this Heath Parasol has been completed in this country since the war with a J.A.P.-built Aeronca engine. Span is 31 feet and fuselage is welded steel tube, popular in U.S.A. *Left*, the **BRITISH** Motor Tutor with 36 h.p. J.A.P. has operated for 30/- per hour. *Below*, this **BELGIAN** Tipsy Junior is the second machine with 62 h.p. Mikron in place of the J.A.P. originally fitted. This machine is now registered G-AMVP. Note fuselage underdecking. (*Photos by G. A. Cull*)

ULTRA-LIGHT

By G. A. Cull

THE VERY first aeroplane ever to fly was an ultra-light by today's standards, although in 1903 there was no question of different classes of flying machine: nowadays, the ultra-light aeroplane is the humblest of all powered aircraft. £.s.d. is the fundamental reason-why behind the ultra-light, and is manifest in the desire, or even insistence, to fly more cheaply than is possible in an ordinary light aeroplane of which current examples are the Tiger Moth and Auster. This demands an aeroplane without a great thirst for fuel, which costs less initially, and which has all-round simplicity and lack of unessential frills for cheapness and lightness to ensure that the flier gets the best performance for his money. These requirements result in an aeroplane that is primarily small, low-powered and with a light wing-loading, and that is the character of the ultra-light.

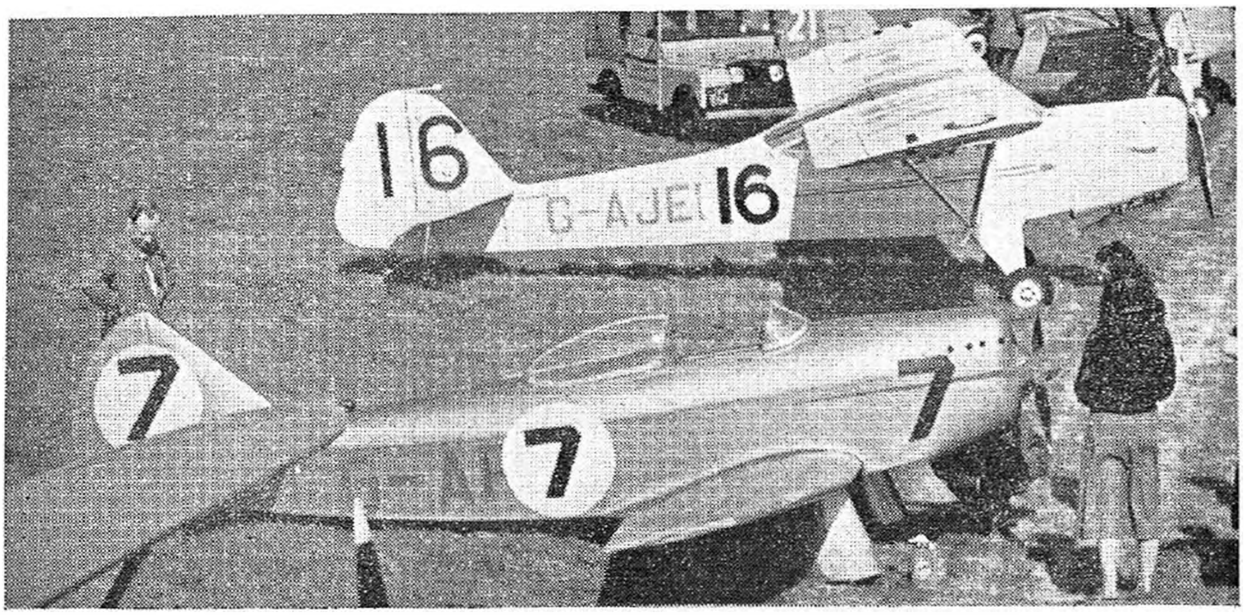
A compromise of this nature was first needed after the first World War had established that flying was sane, and when it was felt that the man-in-the-

Above, the **GERMAN** Zaunkonig, a student-built masterpiece in slow-flying with a 51 h.p. Zundapp engine which is the best ultra-light engine flying today. *Below*, a **FRENCH** amateur-built Bebe Jodel with Volkswagen engine. Many are currently flying. (*Photos by G. A. Cull*)

street really ought to fly. Outstanding among the first designs, were the Austin Whippet and Avro Baby, but in 1923, '24 and '26 the *Daily Mail* and the Air Ministry really got down to it by organising the Lympne Light Aeroplane Trials for single and 2-seaters, and substantial prize money brought forth a good entry with a variety of new engines. The rules made sure that successful machines would be economical and both land and airworthy. Some astounding performances were put up by these pioneers, notably by the A.N.E.C.1. and E. E. Wren, both single seat monoplanes, which both flew 87½ miles on a gallon of petrol. The A.N.E.C. also climbed to the staggering height of 14,400 feet, and that was 32 years ago! In those days everything was very experimental, and it was not uncommon for an engine (usually a converted motor-cycle unit) to throw a con-rod through its crankcase, or for a loaded machine only just to get off the ground. The final two-seater contest was won by the Hawker Cygnet, which weighed under 3½ cwts. empty, but although the aim to find a two-seater for subsidised club training was not realised, the inadequate size of the engines was, and the contests provided a lot of experience and showed just what could, or could not, be done. None of the firms could see their way clear to market their designs and, preferring not to take the risk, big names like Avro, Bristol, Blackburn, Hawker and Short, left this field to pursue more profitable business and have done so ever since. De Havilland did build a dozen or so Humming Birds for the R.A.F. and these were the only ultra-lights ever to wear British uniform. The broken prop. of one which was released and re-engaged to an airship is displayed in the Royal Aero Club, and two Humming Birds were used as the basis of two new designs. Strangely enough, the first one built, G-EBHX, is the sole survivor and is now being rebuilt by its makers.

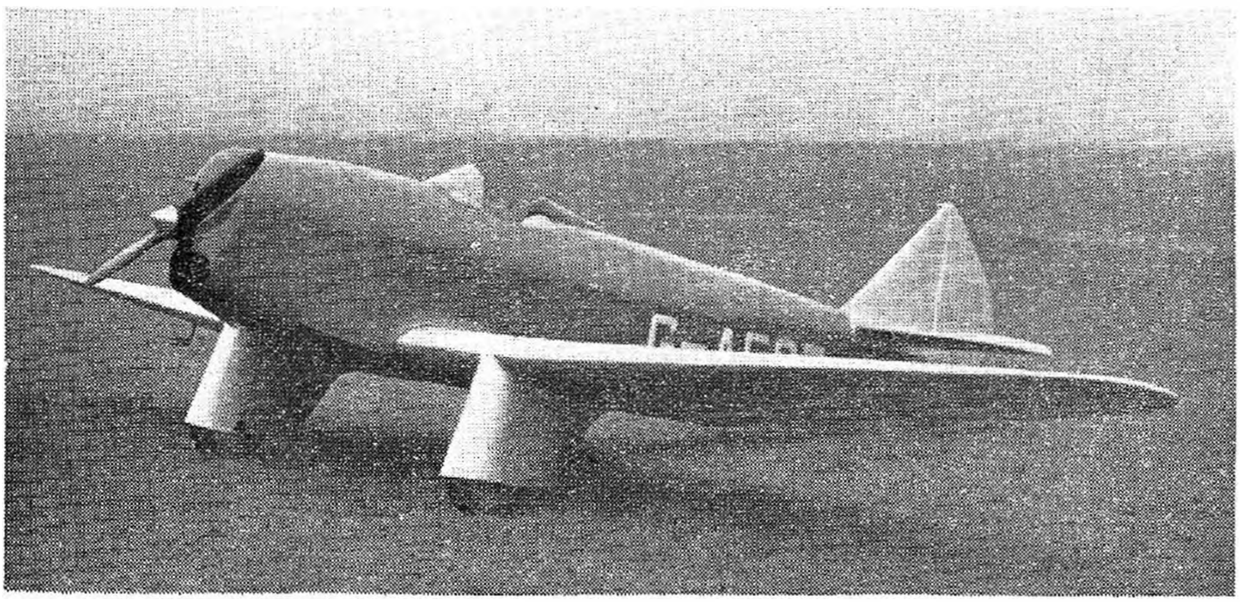
After the Lympne trials, things fell rather flat, and the advent of the higher powered Moth did not help ultra-light matters which, in this country, now all belonged to the small companies. A few types, of which the A.B.C. Robin is best known, appeared in 1929, but very little happened until 1935, except that some Klemm L.25 two-seaters with 40 h.p. Salmson engines were imported in the absence of home-grown designs. The Klemm had beaten all ocmers (the Moth included) in trials on the Continent in 1927, and the fact that

The 130 m.p.h. hotted-up Carden Ford engined Chilton which won the 1951 South Coast race in 1951. Its diminutive size can be appreciated in this view. (*Photo by courtesy of Flight*)



a pair are still flying here is testimony enough. In 1935, the French "Pou de Ciel", mis-translated, gave us the "Flying Flea" and here was something new that really caught on. Until now there had been no truly amateur constructors here, but the Flea's pocket-sized appeal fired many to have a go. Two firms built the Flea with the new Carden engine, which was a modified Ford 10 unit, but the amateurs fitted a host of different engines, since the design was not tied by stringent certificates of Airworthiness requirements, and was merely authorised by a "Permit to Fly". which allowed the use of materials other than those officially approved. The day of the Flea was brief, for its novel aerodynamic layout had faults which proved too much for inexperienced amateurs, and many fatal crashes were suffered. The Flea was banned, but a market had been aroused, and new designs took shape in small new establishments. About the same time as the Flea, the Kronfeld Drone appeared to show another approach to the cheap aeroplane. This was a B.A.C. VII glider, modified to take a pusher engine (Coventry Victory, Douglas or Carden), and the 40 ft. span folded back as in many Lympne types. A number were built, and specimens still exist.

Above, The 1939 Chilton with 44 h.p. Train engine which raced at 126 m.p.h. This supreme British design was killed by the war, but the only machine built still races. *Below*, the standard Carden Ford Chilton of 1937 which did 60 m.p.g. on 32 h.p. Price was £315. (*Photos by courtesy of "Flight"*).

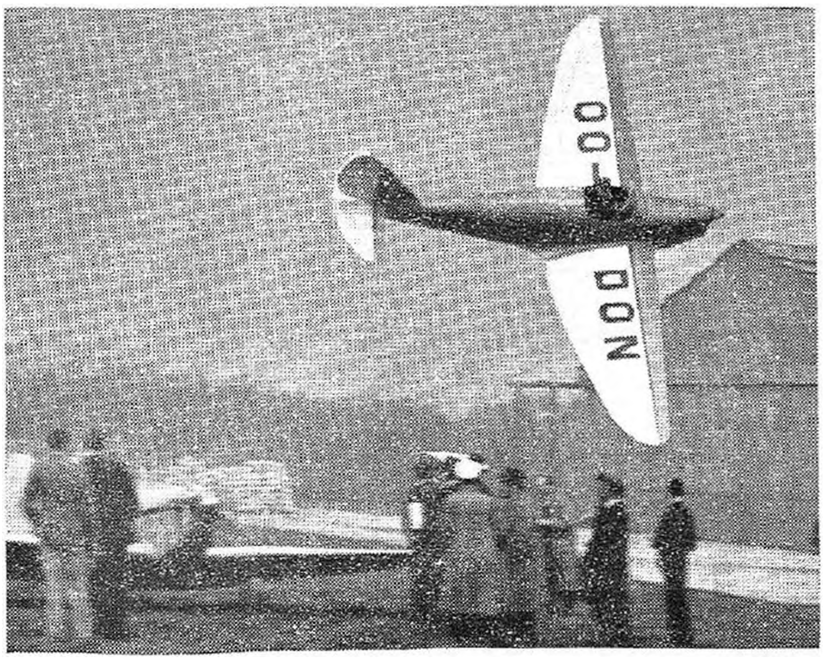


Cherub Drone. This machine crashed early in 1955. (*Photo by C. A. Cull*)

As the spate of activity continued, the new shapes varied as much as their intriguing names. There was the neat low wing Gordon Dove, and the dumpy Brawney Parasol, which used its rudder as a price ticket to state its value at £195. The two Currie Wots were the only biplanes, and the Shapley Kittiwake, the only two-seater. Lying between the Drone idea and the more conventional, came three types on glider lines, the Dart Flittermouse (Scott Flying Squirrel) and Pup (Ava and Cherub), and the elegant low-wing Luton Buzzard (Anzani). The only design which got under way for the Flea-deprived constructors was the Luton Minor, but most of the new designs did not pass the prototype stage, due to economic reasons or because of the imminent war. Imported designs became available "off the peg", and were the Czech Hillson-built Praga two-seater, and the Belgian Tipsy S.2 single seater; the American Aeronca C.3 was also built here. The Aeronca brought its own engine, which J.A.P.'s copied for the British-built Aeroncas. Although not made available for production in any other machine, the J.A.P. found its way into some home designs before the war put a stop to everything ultra-light.

Post-War

After the war, the shallow-pocketed enthusiasts picked up the threads and formed the Ultra Light Aircraft Association to gain an organised footing. The original intention was to design new machines, but the way proved hard, for the Ministry of Civil Aviation and Air Registration Board were now more cautious than in Flea days, and their requirements meant that amateur construction became virtually impossible and removed from a means to cheap flying. Aeroncas and Tipsy two-seaters were the main war survivors and are still going strong, and the rebuilding and completion of unfinished pre-war types was permitted under a Permit to Fly. The spoils of war brought the only new-

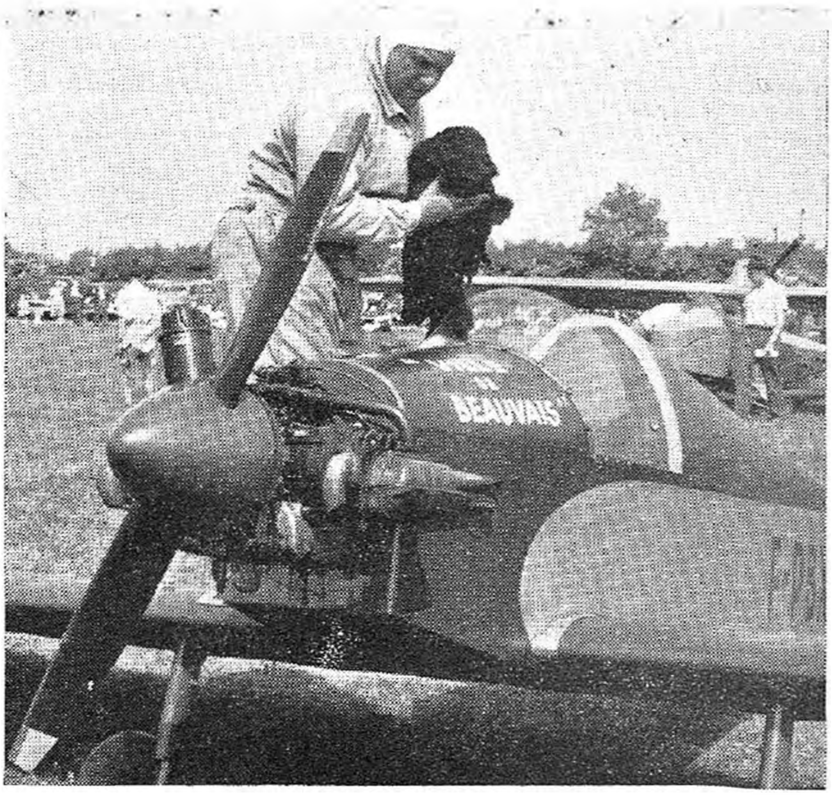


A pre-war photo of a Tipsy 2-seater demonstrating its near-perfect controls. On the ground is a single-seat Tipsy S.2.

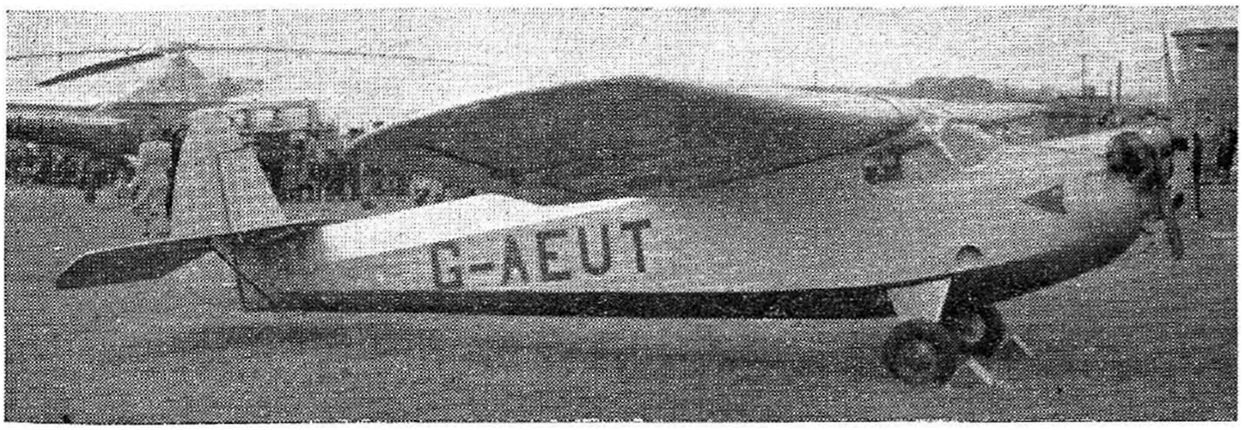
Carden Drone. This machine is still flying and was for sale this year for £140 (*Photo by C. A. Cull*).

comer in the stark shape of the German Zaunkonig, which was bought for the U.L.A.A. for £20, but before long moves were made towards new machines. Both pre-war Dart Kittens were re-furbished and the Kitten III was built. Slingsby's adapted their Tutor glider with wheels and a J.A.P. engine to become the Motor Tutor, and the new Tipsy Junior, designed for amateur construction, arrived from Belgium fitted with a 62 h.p. Mikron, to be followed by another more appropriately powered by a J.A.P., supplied by the U.L.A.A. This was from the stock of 50 unused J.A.P. engines intended for Aeroncas, which the U.L.A.A. acquired. Unfortunately, not one of these hopes became generally available, largely due to the lack of demand for single-seaters and the lack of engines on which to base production. Even the only large concern involved, Fairey Aviation, who control Tipsy affairs, does not consider the marketing of the Junior a good proposition. The lack of suitable engines has been a great stumbling block, and, because of the small demand, no engine manufacturer has found much promise of profit in an ultra-light engine. Hope now lies in the 50 h.p. Coventry Neptune, which is an adapted marine unit currently test flying in a Piper Cub. The present picture of ultra-lights in Britain is of 20 odd "old 'uns", with old engines, namely, Carden engined Chiltons and Drone, J.A.P. Aeroncas, Kittens, Luton Minors, Motor Tutor and Heath Parasol, Mikron-powered Tipsy's, and the veteran Cherub in a Luton Minor and a Heath Parasol.

This state of affairs, however, is gradually improving under the guidance of the Popular Flying Association, as the U.L.A.A. has been renamed. By dint of dogged perseverance, sustained over the years, this organisation is now



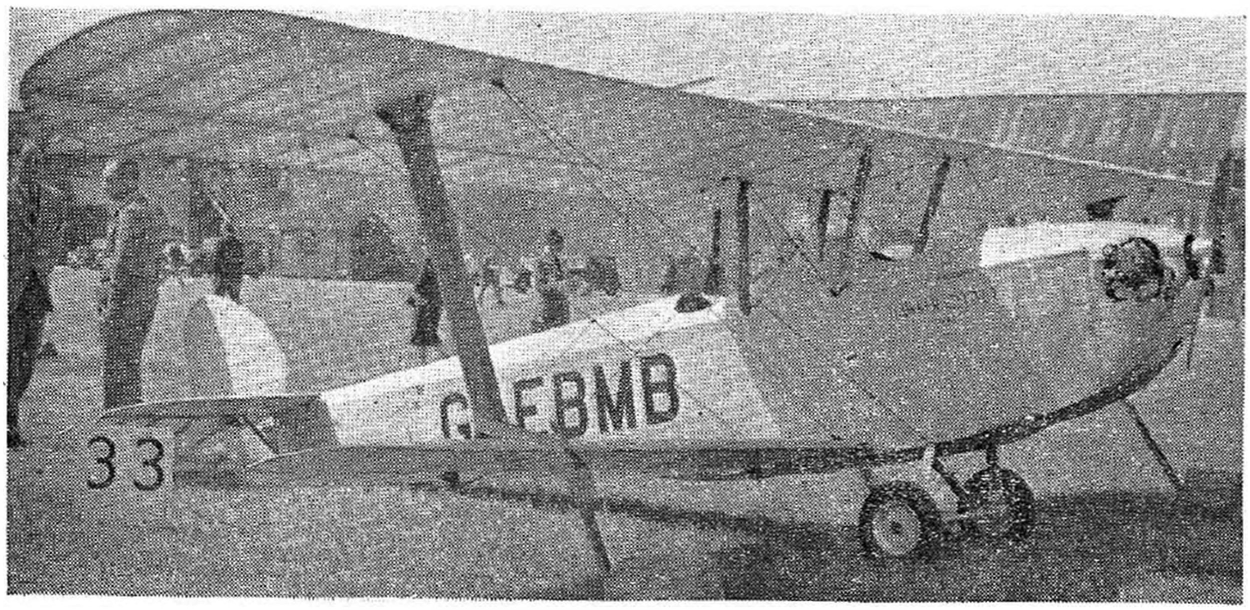
A French amateur constructor with the Bebe Jodel he built and flew across the Channel. (*Photo by G. A. Cull*)

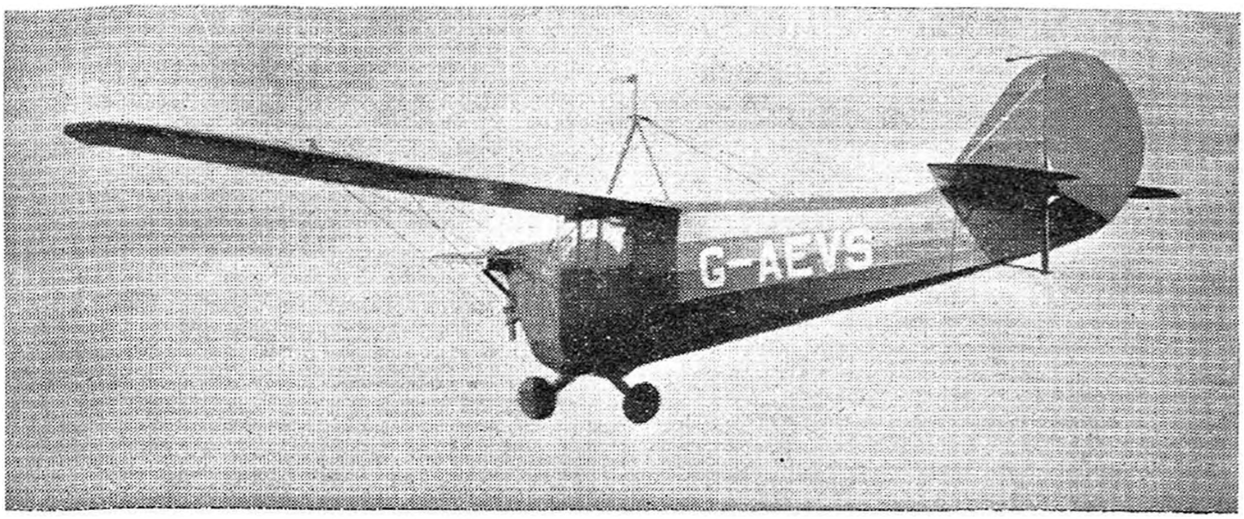


CZECH 2-seater, built in England pre-war, the Hillson Praga Baby. Cockpit access was by the cockpit roof which hinged upwards with leading edge. Price three years ago was £200. (*Photo by G. A. Cull*).

the official governing body for ultra-lights, its authority being delegated from the M.C.A. and A.R.B. The P.F.A. has now set about providing amateur constructors with designs for which engines *are* available by importing the French single-seat Turbulent (Volkswagen car engine) and the two-seater Turbi, for which new Mikron engines are obtainable. In France, which the war left bare of light planes, sheer necessity and an approving Government have given rise to a thriving ultra-light movement, particularly in amateur construction. The first two British amateur Turbis are well under way and will have a new type C. of A. of which the two main points are "no aerobatics" and "not to be used for hire or reward". The P.F.A. has the authority to approve modifications and carry out all inspections while building, and is, in fact, the hub around which all future British ultra-light flying will revolve. So far, enthusiasts have found that co-ownership groups are the means to the cheapest flying; in such a group a machine, usually a war surplus trainer, is operated on a non-profit basis so as to keep costs down to £2 per hour or less. Most popular for this is the two-seat aerobatic Tipsy Trainer with 62 h.p. Mikron, using $3\frac{1}{2}$ gallons per hour (at 4s. 8d. per gallon). Although rather above the average ultra-light, this Tipsy is still a lot less in every way except performance, than the two-seat lightplane,

BRITISH 2-seater of 1924. This Hawker Cygnet with 32 h.p. Cherub is kept in flying trim by its makers. (*Photo by G. A. Cull*).





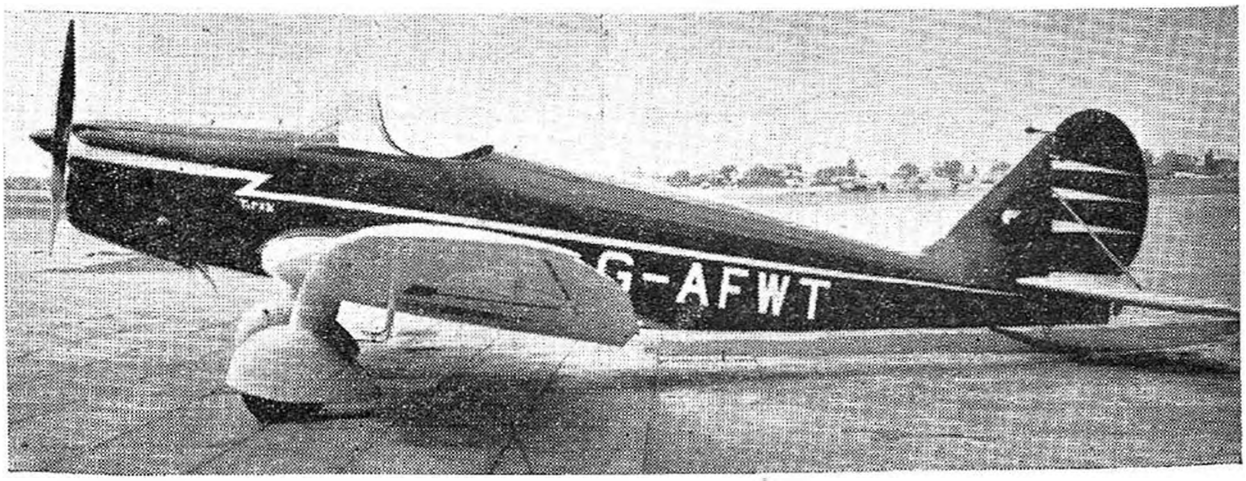
AMERICAN 2-seater, the Aeronca C.3, which uses two gallons per hour. Door on starboard side only.

which seldom manages on less than 90 h.p. nowadays. The P.F.A. define an ultra-light as having an all-up weight of not more than 1,200 lbs. with a stalling speed (power-off) of not more than 40 m.p.h. with full load.

Home Construction

On hearing of home-made aeroplanes, every aeromodeller must dwell for a moment on what this entails. There's a lot more to it than balsa and cement, but every day in France butchers and bakers are flying in machines of their own construction. Wood, being easier to work and cheaper than metal, is the obvious prime material. Fuselage sides are much the same as a model, but instead of being built on the plan, call for accurate measurement in laying out and jigging with scrap wood and cramps during assembly using synthetic resin aero glue. All materials must be obtained with a release note stating official approval for aircraft use, and the timber used is spruce for longerons, spars, stringers, etc., with ash for odd high strength parts. Birch ply is used in numberless places apart from external covering; every joint such as fuselage spacer (about $\frac{5}{8}$ in. x $\frac{5}{16}$ in.) to longeron (about $\frac{5}{8}$ in. square) has a ply gusset plate secured by brass pins and glue, ribs often have part-ply webs, and all-ply tail ribs are common. Wing ribs are invariably of lattice type built with $\frac{5}{16}$ in. square outline, internal uprights and diagonals reinforced by ply gussets. A rib building jig is a board to which are screwed wood blocks to correctly locate the parts as do pins

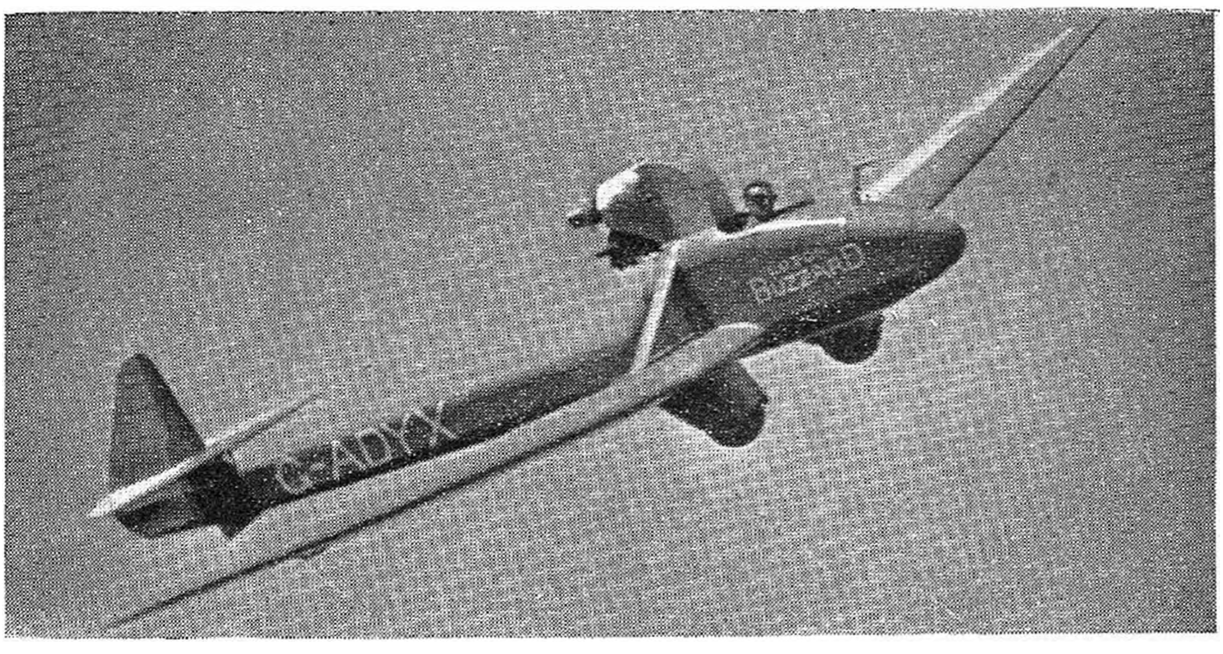
BELGIAN 2-seater. Built in England pre-war, the aerobatic 62 h.p. Tipsy Trainer has built-in slots and pronounced washout.

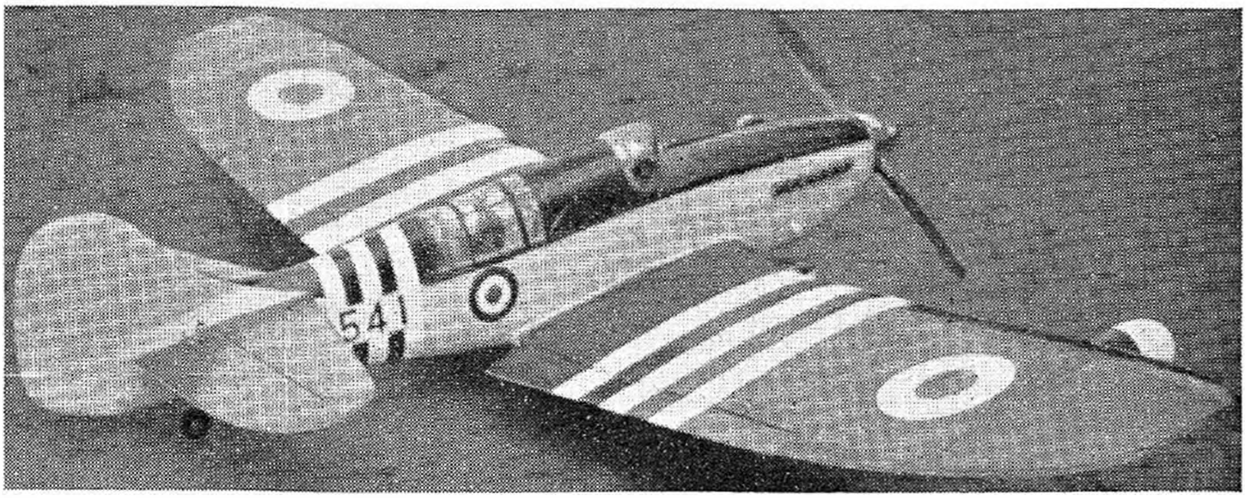


The J.A.P. powered Dark Kitten III is larger and sturdier than most and holds a type Certificate of Airworthiness (*Photo by G. A. Cull*).

on the model plan. All components must mate-up accurately with perfect alignment, so care is vital, but the amateurs' enthusiasm and pride fosters the skill to equal this. At each important stage in construction, inspection by the P.F.A. is necessary to ascertain that all is well. Some of the metal fittings such as undercarriage, engine bearers, and control hinges, require the services of an approved A.R.B. welder to whom these jobs must be taken. Fabric covering is an art to be mastered, and requires an amount of hand sewing as at the wing trailing edge where a special stitch is employed to draw the covering taut. Fabric is held down by "stringing" around the ribs using specified knots which are finally covered by a strip of tape. A workshop is essential but a surprising amount can be done in a small space; a pair of Kitten wings were built on edge in a 14 ft. garden shed, the spars being held against upright posts! Elaborate equipment is not necessary, but the basic metal and woodworking tools are essential and much can be improvised in the way of cramps of which one can't have too many. At present it costs about £300 to build a Turbi, plus hundreds of man hours: the result is a tremendous satisfaction at having created a real aeroplane that will fly more cheaply than most, and which will bear its maker aloft for many times the hours it took to build.

The original Luton Buzzard, later rebuilt with a cabin. (*Photo by courtesy of "Flight"*).





Japanese development of Combat extends to scale kits like this Firefly by Mizugami

COMBAT *By* R. G. MOULTON

Specialised designs begin to appear for this latest and most exciting form of control-line flying

TO ANYONE with experience of piloting a team race, Combat flying is a "natural" follow-on. It allows the individualist to display his particular skills, provides all the thrills of team racing and commands the full attention of spectators for every moment of the flight. That is why Combat has suddenly shot into the limelight at all the big British model rallies and is fast becoming a rival in popularity to team racing itself.

Now, although relatively new to British model fields, Combat is a long established item in contest programmes of Australia, Japan and the U.S.A. There is much to be learned, both from experience in those countries and also from the first few events held in Britain. We hope that this article will help to put matters in their right perspective and introduce the subject to the many modellers who have yet to enjoy the thrill of streamer cutting.

A match (some appropriately refer to it as a Joust—after the duels of Knights of old) consists of two, or more, aerobatic models flying on lines of equal length and each towing a crepe paper streamer about ten feet long. The object of the match is simple, for each opponent attempts to cut the streamer on his opposite number's model, and the eventual winner is the man with the greatest number of scored "cuts". Simplicity is the theme of Combat, there are no restrictions on model design, except for engine capacity, and once airborne, the pilot is free to attack as he pleases, though certain rules of honour are applied to see fairplay. That, in a nutshell, is all there is to know about Combat for the moment. Complications set in as the event gains popularity, and some organisations have tended to overburden the rulebook with involved scoring systems and a few peculiar rules of procedure. These tend to lessen the degree of enjoyment to be derived by those concerned and it is rather fortunate that there are no such standardised rules established in Britain.

The whole essential of Combat is complete freedom for the pilots to attack streamers without restriction and enjoy themselves in the process. Scoring systems have no need to be complex, and should be simple enough for all to understand without fear of argument. In other words, they must be clear

Action launch at the U.S.A.F.E. Championships, Wiesbaden. Model is a commercial design for .35 cu. in. engines and has a cast alloy fuselage to make it unbreakable. Two helpers are needed for launch to see that streamer gets a clear release

Opposite: In Tokyo, Japanese combateers fly scale and semi-scale models built in Kiri wood and with .35 cu. in. engines. Most are flapped and all fly in the clockwise direction, unlike those of other countries

and decisive throughout. With these points in mind, we suggest the following basic rules for British Combat, bearing in mind that in other countries it is usual to have larger engines and longer lines.

Combat Rules

1. The model shall be capable of aerobatics.
2. Line Length, centre of handle to centre-line of model to be 50 ft.
3. Maximum engine capacity 3.5 c.c.
4. Streamer to be 1 in. × 120 in. minimum, crepe paper, attached by 24 in. carpet thread to rear of model.
5. Scoring to be 10 points per cut, or removal of whole streamer.
6. Only cuts made by model contact count, line cuts do not score.
7. Protuberances on wings (pins, glasspaper or thick castor oil) not tolerated.
8. Each "Combat" to last five minutes from signal to start with a penalty of one point per second over and above one minute spent on the ground. Refuelling allowed.

Disqualifications

A. If by pre-arrangement, a flier becomes a "sitting duck"

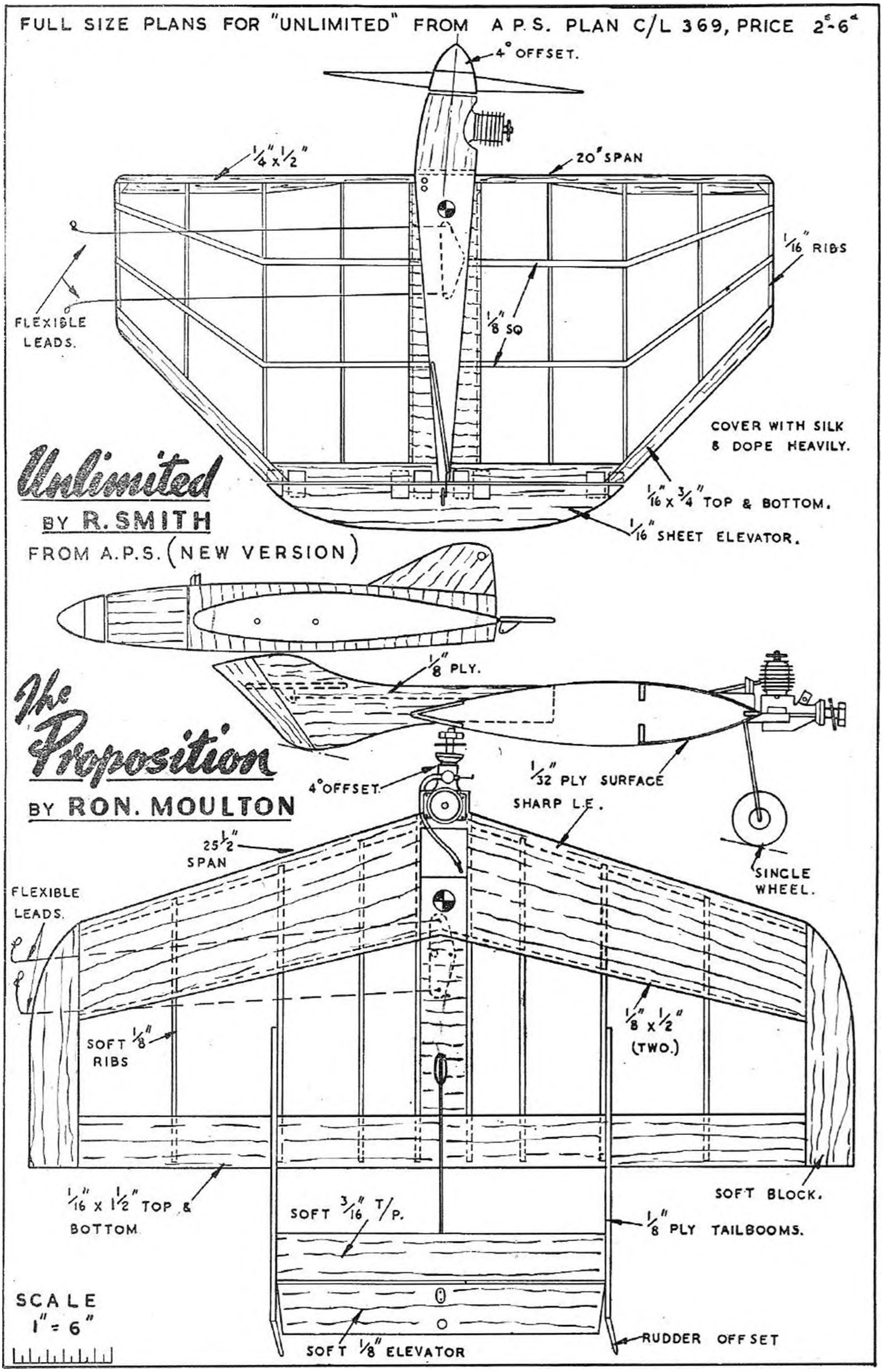
B. For maintaining low level evasive flight over more than three laps.

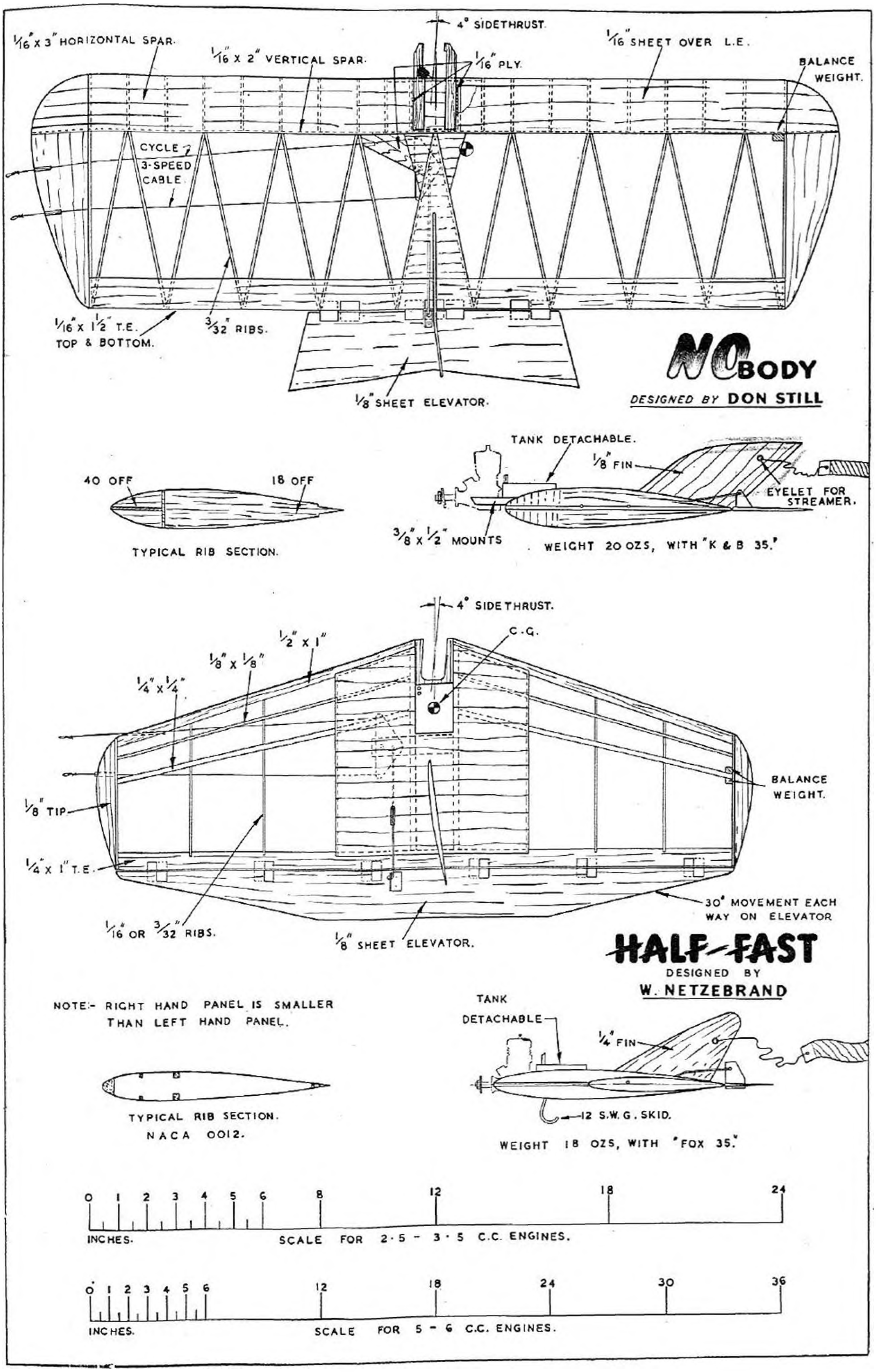
C. For obvious foulplay.

The imaginative will see boundless possibilities within these simple rules. No undercarriage, no processing, and everything to be gained by the model that gets into the air quickly and into the attack. Head-on collisions, in fact any form of collision is tolerated within the condition of not being classified as foulplay by the referee, and the known methods of making a cut easier by arrangement or wing mounted devices are outlawed.

There are, of course, further twists to the rule number eight, which governs the duration of a heat, Joust or "Combat". These are applied in cases where large entries of 75 or more are expected, and the set of rules issued by the Western Associated Modellers, a very experienced body in California, is helpful on this point. They state that all competitors shall be ready for flying with lines and streamers attached. A draw is taken for order of flying, and the first two enter the circuit to fly. Each is allowed two minutes in which to become airborne, and if unsuccessful, the entrant must withdraw and another takes his place immediately. Similarly, a flight terminates on landing, and that entrant must withdraw in favour of the next in line. So at all times the circuit is engaged and one cannot tell who an opponent might be—"he" may even turn out to be as many as three different persons, for each man is allowed six minutes engine run. If unlucky enough to exceed this, all points are lost.

There are of course, disadvantages to such a system from the pilot's point of view, for he might be blessed with a six-minute period in which all the time is taken by swapping opponents in and out of the circuit. But the same situation can arise with the five-minute suggestion of rule eight—though there is no penalty for an engine over-run and five minutes should be enough for even the most baulky of engines to get started. One major difference in California is, that all competitors have three attempts, while our suggested rules are based on the eliminating system used for team racing and terminating with semi-finals and finals.


FULL SIZE PLANS FOR "UNLIMITED" FROM A.P.S. PLAN C/L 369, PRICE 2s-6d
4° OFFSET.
1/4" x 1/2"
20" SPAN
1/16" RIBS
FLEXIBLE LEADS.
1/8" SQ
COVER WITH SILK & DOPE HEAVILY.
Unlimited
BY R. SMITH
FROM A.P.S. (NEW VERSION)
1/16" x 3/4" TOP & BOTTOM.
1/16" SHEET ELEVATOR.
1/8" PLY.
The Proposition
BY RON. MOULTON
4° OFFSET
1/32" PLY SURFACE
SHARP L.E.
25 1/2" SPAN
SINGLE WHEEL.
FLEXIBLE LEADS.
SOFT 1/8" RIBS
1/8" x 1/2" (TWO.)
1/16" x 1 1/2" TOP & BOTTOM
SOFT BLOCK.
SOFT 3/16" T/P.
1/8" PLY TAILBOOMS.
SCALE 1" = 6"
SOFT 1/8" ELEVATOR
RUDDER OFFSET


1/16" x 3" HORIZONTAL SPAR.
1/16 x 2" VERTICAL SPAR.
4° SIDETHRUST.
1/16" PLY.
1/16" SHEET OVER L.E.
BALANCE WEIGHT.
CYCLE 3-SPEED CABLE.
1/16" x 1 1/2" T.E. TOP & BOTTOM.
3/32" RIBS.
1/8" SHEET ELEVATOR.
NOBODY
DESIGNED BY DON STILL
TANK DETACHABLE.
1/8" FIN
EYELET FOR STREAMER.
40 OFF
18 OFF
TYPICAL RIB SECTION.
3/8" x 1/2" MOUNTS
WEIGHT 20 OZS, WITH "K & B 35."
4° SIDETHRUST.
C.G.
1/2" x 1"
1/8" x 1/8"
1/4" x 1/4"
1/8" TIP
1/4" x 1" T.E.
BALANCE WEIGHT.
1/16 OR 3/32" RIBS.
1/8" SHEET ELEVATOR.
30° MOVEMENT EACH WAY ON ELEVATOR
HALF-FAST
DESIGNED BY
W. NETZEBRAND
NOTE:- RIGHT HAND PANEL IS SMALLER THAN LEFT HAND PANEL.
TANK DETACHABLE
1/4" FIN
TYPICAL RIB SECTION.
N A C A 0012.
12 S.W.G. SKID.
WEIGHT 18 OZS, WITH "FOX 35."
0 1 2 3 4 5 6 8 12 18 24
INCHES.
SCALE FOR 2·5 - 3·5 C.C. ENGINES.
0 1 2 3 4 5 6 12 18 24 30 36
INCHES.
SCALE FOR 5 - 6 C.C. ENGINES.

Perhaps an ideal mixture of the two schemes, which would satisfy the handle-happy boys, who get tired of waiting around for a series of heats and semi-finals to pass by, with at very best, a chance of three flights in a whole day, would be that tried out at the South Midland Area Gala this year.

Unlimited number of flights or attempts are allowed, providing that control regulates the flow of competitors to the circuit and gives each a fair turn at Combat. Entry fee is reduced to a third of normal for a combat flight, and thus a flier can go into the arena as many times as he can afford, with at least three flights for the price of a normal one at events run on the eliminator basis.

At the close of day, all scores are totalled, and the one with highest points is declared winner. There are no semi-finals or finals, and although it sounds as though the richest man might win, practice indicates that the genuinely superior flier emerges victorious, and the many also-rans get a lot of fun for their money. At the same time, the spectator angle has to be considered, and this latter system certainly keeps the circle busy as a sideshow at the fairground.

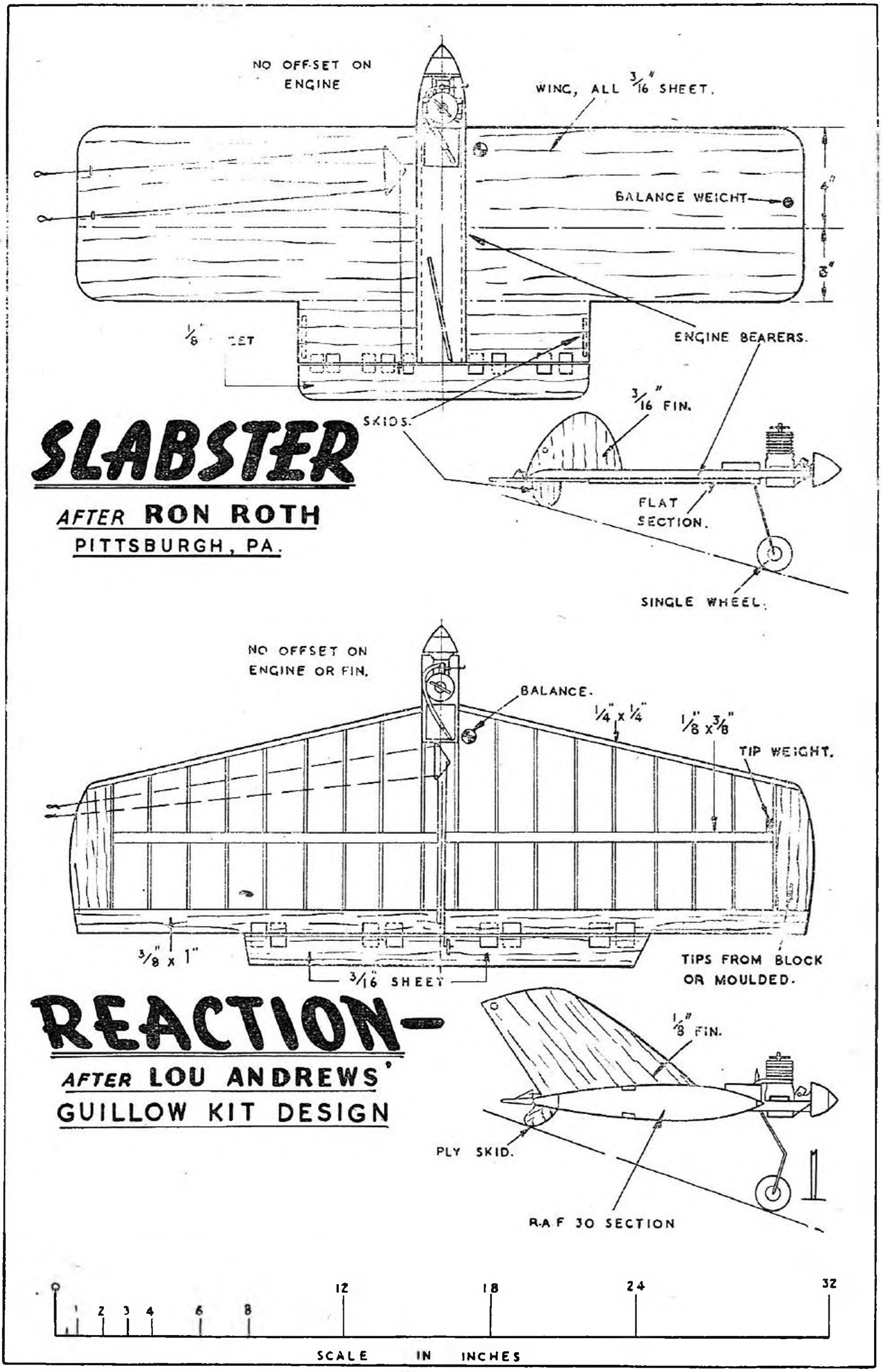
It should be emphasised that the penalty points for being "grounded" only count *against* the unfortunate man who is unable to get airborne after the first minute, or lands again within the flight period. These points do in no way go to the advantage of the opponent, for after all, the idea is to win points by merit and not by the misfortunes of another.

So much for the event, now what of the model?

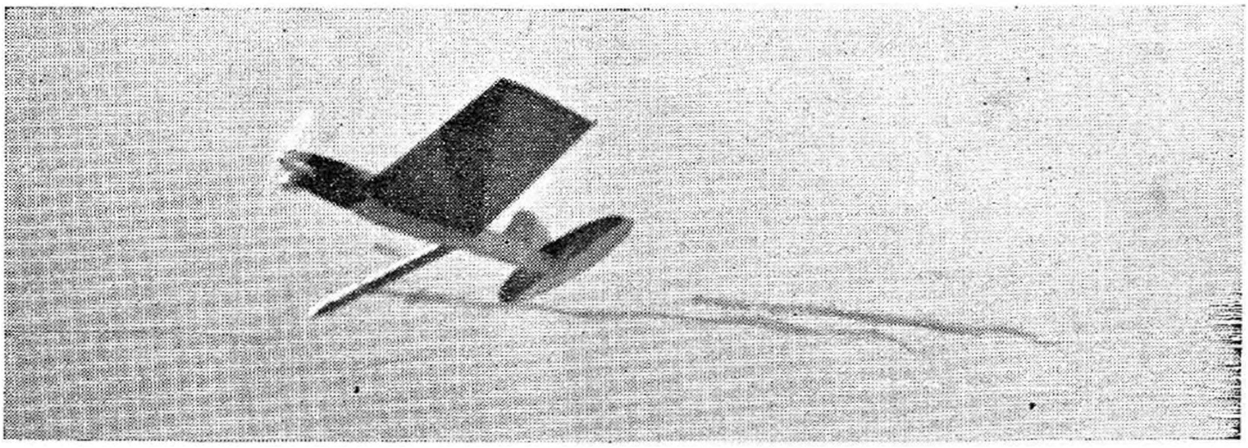
First try your hand at combat with an old model suitably strengthened and possibly given an extra covering of heavyweight tissue for extra resistance to a hasty landing. Any model will do, providing it can take a short spell of inverted flight and will execute a loop, and with the co-operation of a pal similarly equipped, you can soon get into the swing of things and pick up the knack of quick evasion. For that is one key to success in combat—quick reaction and the confidence to slam on wrist movement in a tight situation that might appear hopeless. One soon loses sense of horizon and direction if engaged in a well-matched session, and most of the manoeuvres that simply just happen are not to be found in the S.M.A.E. stunt schedule, and not always executed at the express desire of the pilot!

So we need a good model: but not one of "Gold Trophy" standard, and it must be a toughie, though not too heavy. In the U.S.A. every accent is placed on light weight at the sacrifice of crash resistance and this is done in an effort to reduce the looping radius as much as possible, yet still to have a fast flier. The old argument that a slow and highly manoeuvreable oversize barndoor type of design will oust a fast and snappy model, has been disposed of as a fallacy. What we need is a combination of speed and tight looping, and to get the ideal in this, the model eventually becomes one of the frail dispensable class, weighing in the U.S.A. only 15 to 16 ounces for a most powerful 6 c.c. glowplug engine.

For our smaller models, using up to 3.5 c.c. and mostly diesel, or .19 cu. in. glowplug powered, we can afford to design more for strength and still get the speed and turning radius required. Most of the models in current use are to the conventional pattern of box section fuselage with slab wing mounted on top and sheet tail surfaces, or alternatively, they have solid profile fuselages and fixed, mid-mounted wings. Gradually this conventional approach has



NO OFF-SET ON ENGINE
WING, ALL 3/16" SHEET.
4"
BALANCE WEIGHT
3"
ENGINE BEARERS.
1/8"
SKIDS.
3/16" FIN.
SLABSTER
AFTER RON ROTH
PITTSBURGH, PA.
FLAT SECTION.
SINGLE WHEEL.
NO OFFSET ON ENGINE OR FIN.
BALANCE.
1/4" x 1/4"
1/8" x 3/8"
TIP WEIGHT.
3/8" x 1"
3/16" SHEET
TIPS FROM BLOCK OR MOULDED.
REACTION
AFTER LOU ANDREWS'
GUILLOW KIT DESIGN
1/8" FIN.
PLY SKID.
R.A.F 30 SECTION
0 1 2 3 4 6 8 12 18 24 32
SCALE IN INCHES



Catching a streamer too close can land the attacker in trouble as witness this damaged model in a U.S.A.F.E. meeting

given way to new thoughts on design, and an entirely new form of model has emerged, largely as a result of American design influence.

The thought underlying this new approach is roughly like this. If we do not have to fly to a pattern and have to bring the model through all sorts of indescribable manoeuvres, then we can dispense with the conventional long tail moment arm and save a lot of weight by chopping out the section of fuselage between wing and tail. So the elevator makes acquaintance with the trailing edge of the wing, rather like a flap. Now if we cut away weight at the rear, we can also save a little in front of the wing, so the engine is brought back to balance the wing at the usual position, just on the front line.

All of this results in complete loss of the elevator and fuselage, for the engine is now mounted on the leading edge and the tank has to be accommodated in whatever space can be found. It looks like a flying plank and the standard of manoeuvres borders on the incredulous.

To try out such a model, we took an old glider tailplane of symmetrical section, measuring 8 in. × 36 in., added a 2 in. × 12 in. elevator at the centre trailing edge, and mounted an Allen Mercury 25 diesel on a ply plate in the leading edge with about three degrees right sidethrust. Tip weight and an offset fin completed the "Wing-Ding" and first tests were made in calm weather. A major surprise came with the first lap, when the mildest of elevator motion produced two consecutive loops, the second of which was not intentional; but merely part of the recovery procedure! From then on, nothing came as a surprise with the "Wing-Ding" and for the first time we found ourselves able to construct aerial chain-mail and double vertical eights, so tight was the turning radius. This was in calm weather.

A wind blowing at up to 25 m.p.h. on the second outing, was to change our thoughts of approval! With wing loading at 5 ounces per square foot and relatively large span of 36 in for 2.5 c.c., the wing flew where it wanted when going into wind, and frequently presented us with a complete plan view when crosswind! In later days, the wing met its end in a glorious mid-air collision: but not until after it had given us the information we had wanted.

Span had to be reduced, aspect ratio also brought to a lower figure, and elevator on such a layout, cut down to narrower chord or smaller area. All of which adds up to the kind of model developed in the U.S.A., such as the NObody and Half-Fast. To some extent the streamer helps as a stabiliser on smaller diesel versions of these designs; but one should not rely on always being able to complete a flight with streamer intact!

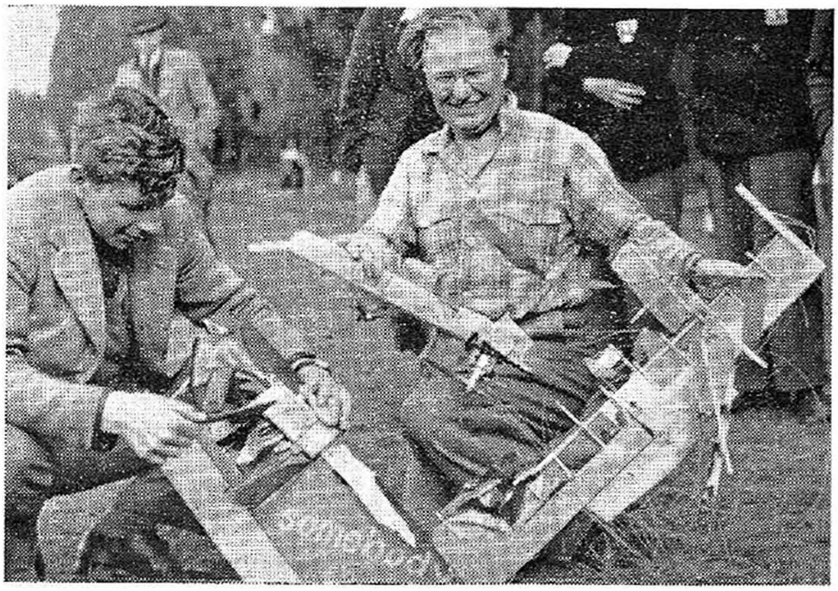
Structurally, the idea of a "wing" model appeals to those who prefer to fly rather than to build. There is less to make, they are easier to repair and a week of evenings is enough spare time for a complete new model to be made. No wonder they are fast becoming popular.

There is another advantage in that extra sheeting can be used in the leading edge, forward of the spar, without upsetting balance or increasing the weight too much. One modeller has even suggested that a fibreglass or ply leading edge covering could be used to advantage and this would certainly render such a project virtually indescructible, if a trifle weighty. There are so many points in favour of the "wing" that the conventional model with separate wing and tail begins to take a back seat, though it will still come to the forefront in expert hands.

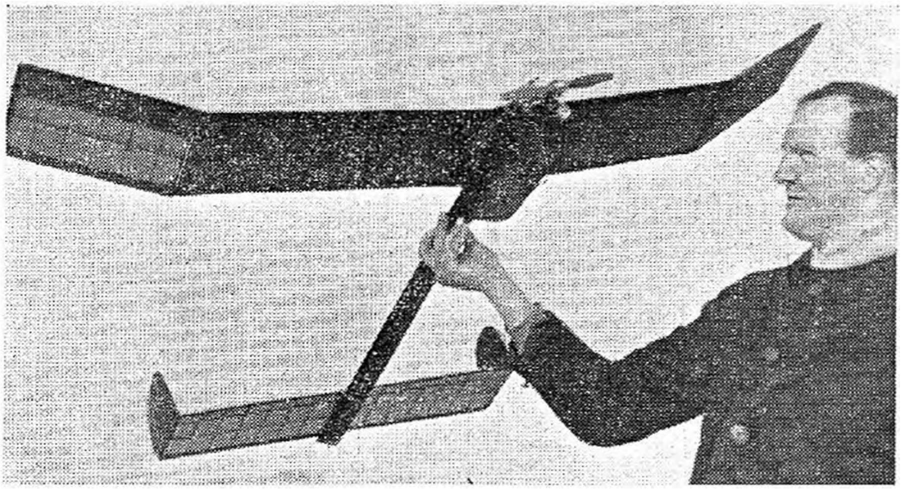
To many in Britain, this talk of the wing as a highly manoeuvreable layout will not come as any surprise, and these will be the people who have built W. R. Smith's amazing "Unlimited" design, for many years a favourite "unbreakable" stunter in *Aeromodeller Plans Service* as plan CL/369. If covered with silk or nylon, this model is as near to being unbreakable as one can get, and its performance with a 2.5 c.c. engine (modern details are on the latest drawing showing beam mounts), is all one could desire for combat . . . the price is only 2s. 6d. per plan.

Now, how to fly?

First and foremost, be aggressive. A passive Combat flier who potters around the circuit and takes the mildest evasive action when attacked, is a damper at any combat event. Go for your opponent's streamer as soon as you get into the air, get behind him, try to anticipate his actions and see if he repeats his method of evasion each time you get on his tail. If he loops out from in front of your model, loop with him and ten-to-one he will go forward into the top half of an eight . . . straight up and in theory you'll fly through his streamer. Remember you have to drag that crepe paper through your prop to make sure of a cut, so judge your radius, and keep your hand near as you can to the other man. His streamer will trail a little out of the circle, so if anything, be on his "outside" and pull on your lines as you pass the streamer so that you get a traverse action across the paper. Does he want to fly low? Then go at him inverted, he won't like it after the first pass if you can make it a close one, and if he just wants to pass the five minutes at playing wingovers, work at him where he pulls out—few people know where they are at that stage.



All's well that ends . . . well perhaps not so well after all! The author (*right*) and Martin Dilly contemplate the results of the Dartford Combat event



Author Jim Waldron shows the salient features of one of his highly developed models. Note twin fins, nose keel, down-thrust and adjustable camber panel of starboard outer wing

MODELS WITHOUT PYLONS

By J. G. Waldron

Any power contest these days is generally a procession of pylon type models, of depressingly stereotyped design, some performing extremely well, others not so well, but all sporting the same high wing layout first introduced in 1938 by Carl Goldberg.

Not that it is the writer's intention here to decry the pylon model, but it is certainly his opinion that the shoulder wing model is as capable of taking its place among the prizewinners as its high winged brethren.

Generally speaking, shoulder wing, or high-thrust-line models fall into four separate classes or "types", and although classified under a general title, their individual layouts do have a bearing on the power trim, and they are as follows:—

1. "Hatchet" type.
2. "Modified Hatchet" type
3. "Bethwaite" type.
4. Pure shoulder wing type.

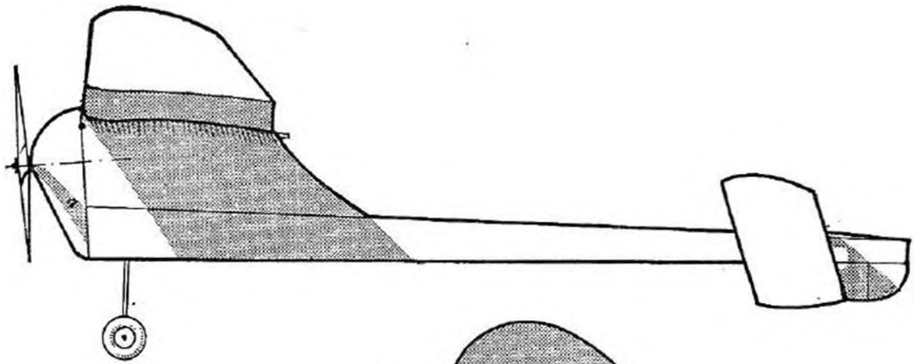
With all of these, the feature isolating them from other types of model is that the wing is itself in the propeller slipstream, and not above it as in the pylon layout, or below it as in unorthodox designs.

The "Hatchet type" models can be very roughly described as resembling pylon models in fuselage outline, but with the engine mounted at the top, instead of the bottom of the pylon. Together with the "Modified Hatchet" type they are the most commonly seen, typical models being the "Jersey Javelin", by Walt Schroder, "Elf-Axe", by John Lamble, "Amazon" and "Amazoom" by Stan Hill, "Komet" by Gerhard Schmid, and the "Ascender" by John Chinn.

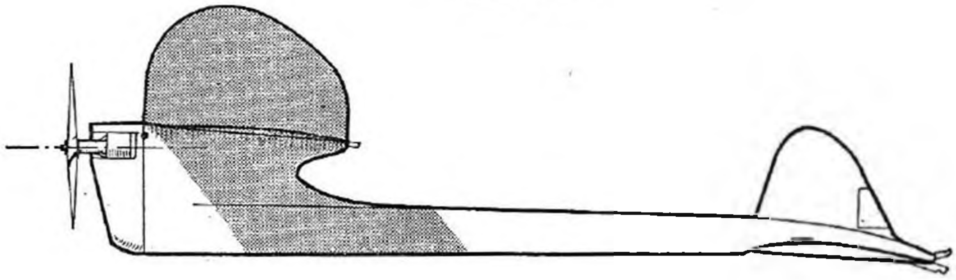
Of these, the "Ascender" stands out as being the most successful British design, and the "Amazon" the most outstanding foreign design, although the less spectacular "Komet" also placed 1st in 1951, and 2nd in the 1952 International.

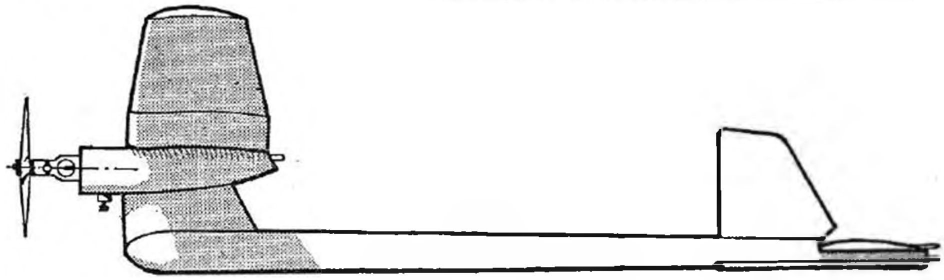
The "Ascender" has appeared in 1.5 c.c., 2.5 c.c. and 3.5 c.c. versions, the latter model winning the 1951 Halfax Trophy, and unlike the other models of this type described has twin fins, clear of the propeller slipstream. Down-thrust is used more than on the "Amazon" which, however, has a fairly high engine, this compensating for the angle, as explained later in the section on trimming. (Fig. 2.)

TYPE 1.
'ASCENDER'.
by
J. CHINN
AMCO 3·5



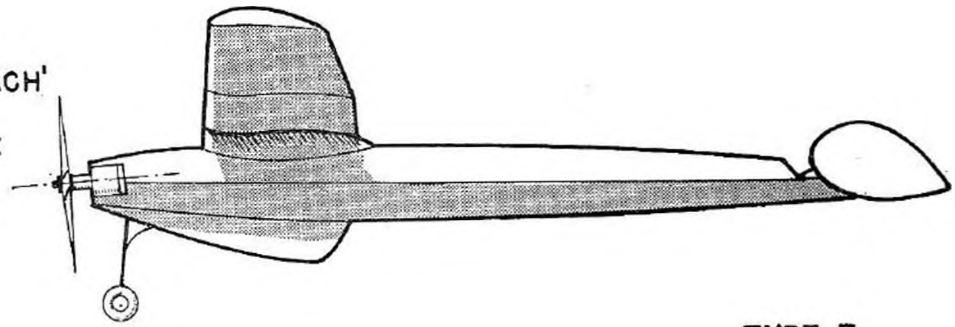
TYPE 1.
'ELF-AXE'
by
J. LAMBLE
ELFIN 1·49



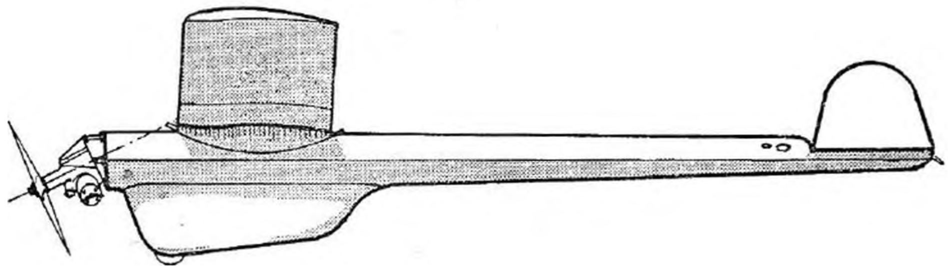


TYPE 2.
'TRIPLE THREAT'
by
LEE RENAUD
Mc COY ·049

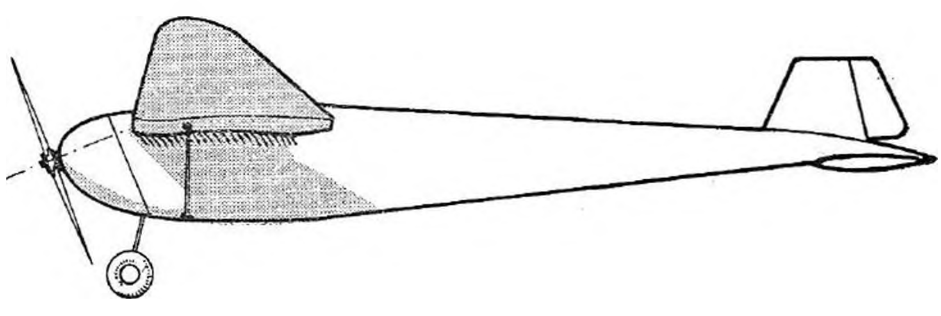
TYPE 3.
ONE MANS APPROACH'
by
FRANK BETHWAITE
ETA 29



TYPE 3.
'PYLOS 4'
by
D.C. PAINTER
OLIVER TIGER 2·49



TYPE 4.
'FLANDERS FLYER'
by
GASTON JOOSTENS
SUPER DELMO 5 C.C.



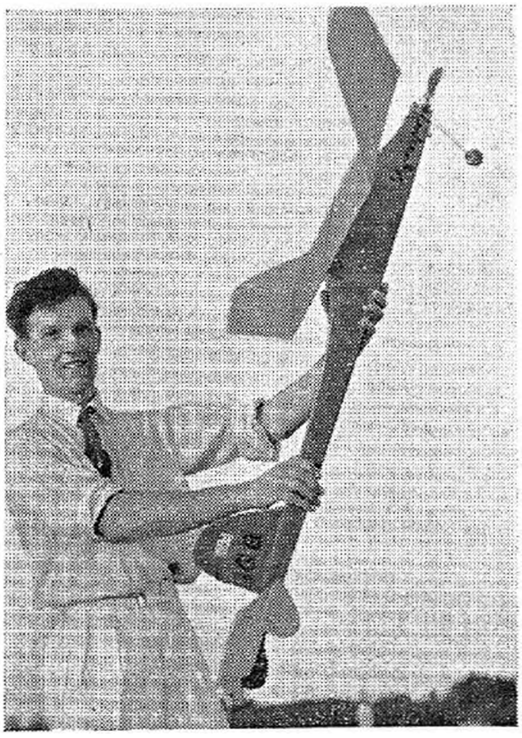
The other three models also use no downthrust, the "Jersey Javelin" because it is a highly loaded model with a wing loading of a little over 10 oz./sq. ft., which eases the looping problems, and the "Komet" and "Elf-Axe" because they are moderately powered designs, of large area and weight in proportion to their engine capacity, also the "Komet" has the engine mounted high, above the wing in fact.

"Modified Hatchet" types resemble the latter in general layout but feature a separate nacelle with engine and wings attached, and connected to a fuselage boom by a sheet keel, one well known kit model of this type being the Frog "Powavan". Other models in this category are the "Tototl" by De Cosio, "Triple Threat" by Lee Renaud, and "Fighting Cock" by Kempen.

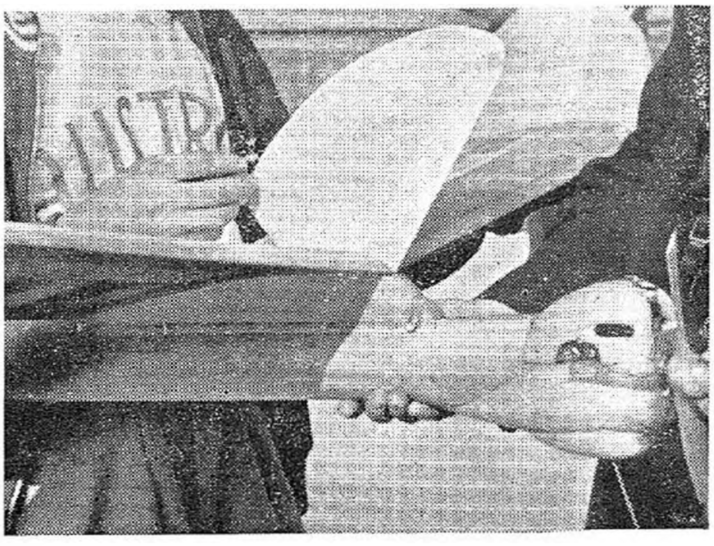
As with the "Jersey Javelin", the "Powavan" is fairly heavily loaded, both in wing and power loading, and this means that looping is not a problem. This model has a particularly safe and efficient climb performance. The other three models also use a little downthrust, the "Triple Threat" being an 0.8 c.c. design, and the others 2.5 c.c. International class models. "Tototl" has a rather highly tapered wing plan, the trailing edge being swept sharply forward, and although not seen often, this taper is really a desirable feature on any power model, improving rate of roll, and aiding structural rigidity, and resistance to wing flexing very considerably. Kempen's design, on the other hand, has large end plates on a parallel chord wing, these reducing induced drag and providing resistance to circling.

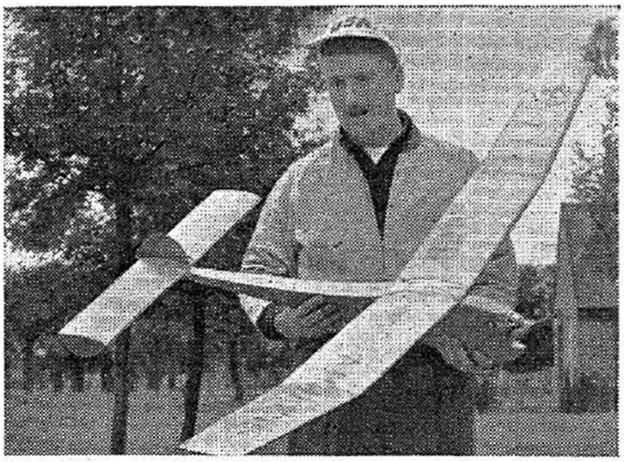
"Bethwaite" type models are far less common than the other types, having appeared only in the hands of the New Zealand aeromodeller Frank Bethwaite, and in developed form by members of the Henley club in Britain.

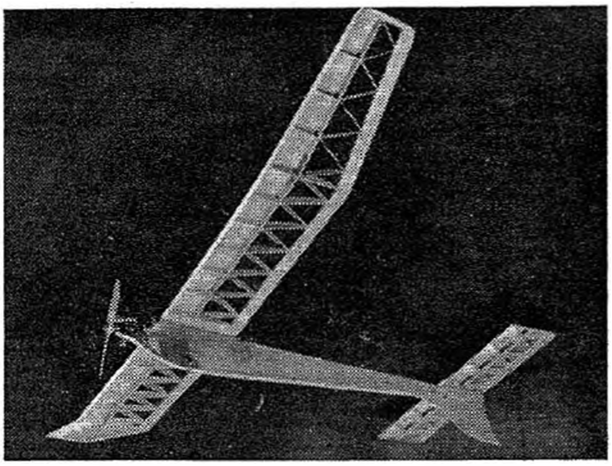
Basically they represent an approach in which the propeller slipstream is intercepted by a keel, and the resultant effect used as a means of power-on trimming. In layout, the fuselage has a sheet keel mounted under and forward of the C.G. with wings mounted directly on the fuselage and the tailplane having twin fins located clear of the propeller slipstream, a layout using similar principles,



At eft, the Loughborough College pendulum-controlled elevator is demonstrated by Max Byrd. Elevator goes down at this angle of climb. *Below* is the Austrian approach to a forward keel with a large fin over centre section







Left, Stan Hill of the U.S.A. with his famous K. & B. 15 Amazon, actually designed by his wife Sandra, and *right*, the '55 development for a Webra Mach I, with simplified fuselage, underfin for VTO and known as Amazoom.

but with the keel mounted over the wing and having a "Tooth Pick" type of fuselage has also appeared, flown by Lederer of Austria.

Bethwaite's model was a large 5 c.c. design, with rather higher wing loading than is usual these days, while the Henley versions by Painter and the author have similar power loading, (7 oz./c.c.) but lower wing loading, (6 oz./sq. ft.) and this has meant that use of large degrees of downthrust to prevent looping has been necessary. Although much criticised on this account, this approach has produced fairly consistent results, as can be seen by the 1954 and 1955 contest results.

To date, development of the basic model has been concentrated on detail design and trimming, and the models themselves have been kept fairly straightforward and rugged in construction. With further development it is expected to improve performance quite considerably however, and an experimental version is currently flying with no downthrust.

Pure shoulder wing types can be described as having plain (usually box-section) fuselages, and no extraneous structure or attached keels; typical models being the "Flanders Flyer" by Gaston Joostens, "Jumpin Bean" by Pete Wyatt, and the Loughborough College models.

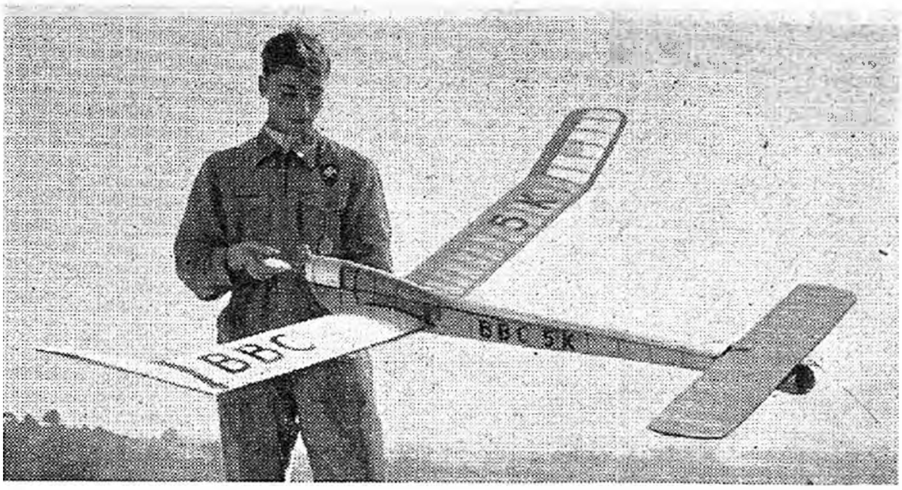
The "Flanders Flyer" was noted for the enormous amount of downthrust it used, and also its pendulum rudder, which has since been used very successfully on scale models. The "Flyer" was a light model for the size of power plant fitted, (up to 5 c.c.), and was also interesting structurally, with plug-in braced wings, of tapered plan form, and ultra simple construction.

Peter Wyatt's "Jumpin Bean" is a small model, for 0.5 c.c. engines, although derived from a 1.5 c.c. version, and yet it too uses a fairly generous downthrust angle of 15°, but no pendulum rudder is fitted.

Differing from the two foregoing models, the Loughborough College club design uses no downthrust, instead a pendulum elevator is fitted which compensates by increasing tail lift at a high angle. The pendulum itself is contained in the fuselage in the region of the C.G., the fuselage underside being bulged locally in order to allow unrestricted movement. Max Byrd qualified for the British International team in 1952, flying one of these models.

Trimming

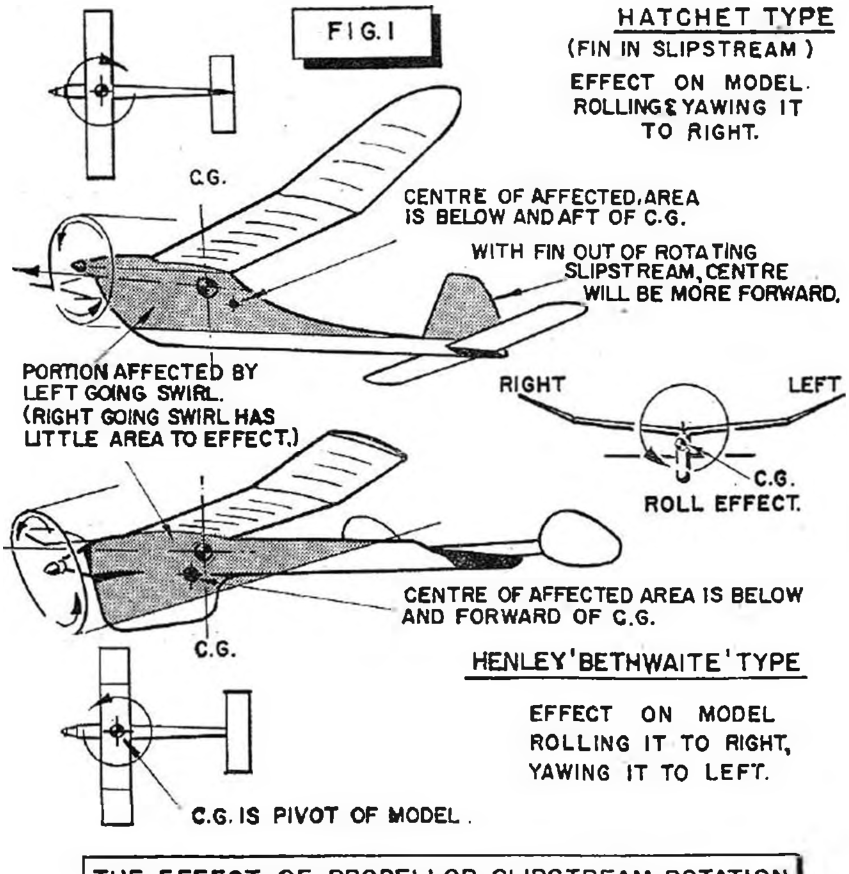
Before discussing the aspects of power-on trimming, it is first necessary to examine briefly some of the factors concerned.



The famous Swiss Komet design by Gerhard Schmid has a glide that modellers envy, though it lacks rate of climb for present day performance requirements

Layout of thè model has a definite bearing on the effect of slipstream rotation, which induces both rolling and yawing moments, themselves dependent in magnitude on the extent and location of the affected side areas, wings and tailplane, relative to the C.G. The general effect is summarised in Fig. 1, the rolling moment is usually not considerable, especially as it is opposed to the torque reaction, but the yawing moment is of much greater consequence, more so if the tail fin is directly in the propeller slipstream. On all high thrustline models, it is the lower left-going swirl of this slipstream which reacts on the side areas, and the fore and aft location of the centre of this area which governs the direction of yaw.

On "Hatchet" types, with fin in slipstream, this centre is aft of the C.G., and on Henley "Bethwaite" types, is forward of it, providing a right and left hand yaw respectively. This combines with the roll to produce a nose down reaction on "Hatchet" types turning right, and yet allows "Bethwaite" types to be safely turned to left or right.



THE EFFECT OF PROPELLOR SLIPSTREAM ROTATION

With pure shoulder-wing types, having less deep fuselages, slipstream rotation has much less effect providing no downthrust is used. If this is used, the yaw will be similar to the "Hatchet" type, while if used excessively, with only the forward portion of the fuselage in the propeller slipstream, the effect will be similar to the "Bethwaite" type.

In all these cases, even ignoring fuselage effect, a roll will be in duced by the effect on the wings, and where appropriate, tailplane. Alteration of the side-thrust can modify the yawing moment considerably, this effect also being combined with the turn resulting from the thrustline alterations, which will either augment or reduce it.

As is quite well known, torque reaction rolls the model to the left, decreasing in effect with an increase in r.p.m., and can be of use in providing a roll component when turning the model to the right.

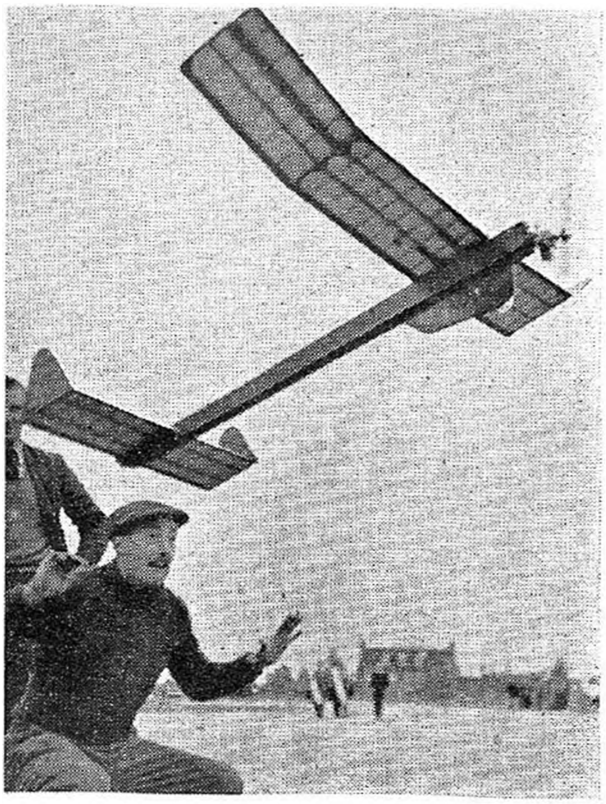
Another less appreciated factor is gyroscopic precession, which tilts the models nose-up in a left hand turn, and the nose down in a right hand turn; in a loop, precession is to the right. It can be seen that this factor will aggravate looping in a high powered model turning left, yet hold the nose down when turning right, this then being a useful safety factor. On the other hand it can be useful on a low power model, holding the nose up when turning left, the nose down safety factor not here being necessary.

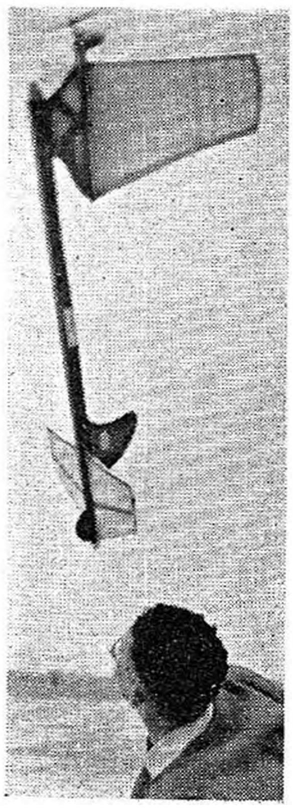
It might seem that the safest power trim would be "straight up", and this can be so with low and moderately powered models, if one can accept or eliminate the possible loss of height at the end of the motor run. Also, with a straight climb, more care is needed to ensure that a moderately powered model is not climbing too steeply, and inefficiently. Often, in cases of this nature, application of downthrust will result in a faster rate of climb, it being more efficient to derive lift from the wings than the propeller.

However, with high power, prevention of looping becomes a major problem, and straight climb impossible with safety and consistency, therefore application of turn becomes necessary, and for stability, this must be combined with roll, which leads to a spiral flight path. From the foregoing considerations, high powered, "Bethwaite" type models are best flown to the right under power, and "Hatchet" types to the left (accepting precession troubles), while all low or moderately powered models are best flown to the left.

Spiral Climb

Any model rigged for maximum glide performance is flying near the stall





Difference in immediate flight attitude after take-off is evident here where both models are released in the vertical attitude.

At left, Dave Painter of Henley has his "Pylos" cocking its tail and climbing fast at reasonable angle while, *at right*, G. Archer has his model continue on the same near vertical line, though not so fast

(CL 1:5/Cd as great as possible), increasing the flying speed by engine thrust, increases lift and climb angle to a point where looping occurs.

With both pylon and shoulder wing models, the initial steps are to open out the looping radius, and in both cases, fine angles (1-2.) between wings and tailplane are used, together with C.G. positions of 75 to 95% M.A.C.—(this rigging being quite permissible with the shoulder wing layout providing adequate tailplane area and moment arm are used). Use of a thick tailplane section can also prevent rigging angles becoming too fine, and also give an increase in tailplane lift at speed, compared to thinner sections.

However, as the model is still rigged to retain an adequate glide performance, these initial steps will not completely prevent looping, and to do this, three courses are open, being as follows:—

1. Downthrust.
2. Turn (and associated roll)
3. Mechanical means (i.e. Pendulum operated elevators, etc.).

In pylon models, downthrust is very rarely used excessively, instead reliance is usually made on the high inherent rate of roll obtainable with this layout, and this ability to "recover" laterally enables a sufficiency of turn to be applied in order to prevent looping. A not uncommon approach with the pylon layout is to allow the model to loop, and rely on it rolling out at, or near the top, a method which although it can produce a reasonable flight pattern, is not conducive to accurate trimming and consistency.

Such methods are not so readily practicable with shoulder winged models; due to their lower wing position natural rate of roll (without resorting to excessive dihedral) is much lower, and it is not safe to apply a great deal of turn. Instead, use of downthrust or mechanical aids becomes more necessary, the former often being used to an apparently excessive degree.

With downthrust, loss of forward thrust due to the engine's inclination is not as great as is popularly imagined—see Fig. 2, the greatest losses occur at the wing centre-section due to the drag caused by directing the propeller slipstream at it from a steep angle. Slotting the wing locally as shown, can prevent the stall at this point, and thereby reduce the drag, but positioning of the engine either high, or on a long nose can reduce the angle required, while still retaining its effectiveness. The only drawbacks with the latter course being the increased sensitivity to side-thrust adjustment and difficulty in locating the C.G. correctly with a heavy engine.

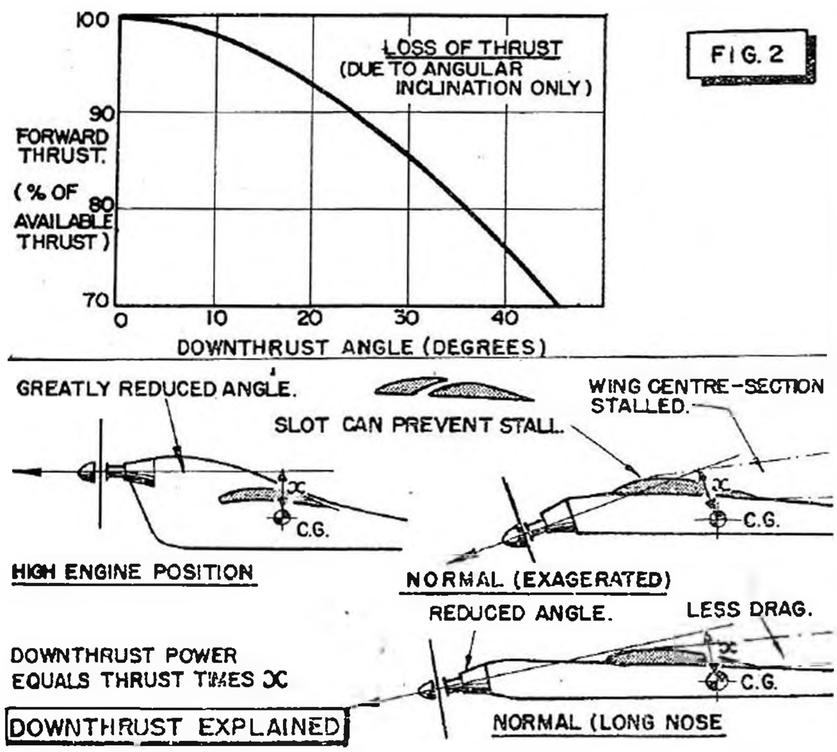


FIG. 2

Mechanical aids can replace downthrust by increasing tailplane lift, and fall into two categories:—

1. Pendulum controls—in this case elevators.
2. Engine timer operated controls, such as variable incidence tailplanes.

The former suffer from inertia and centrifugal effects, and do not appear sufficiently precise in operation for contest flying, although used successfully in some quarters, but the latter are feasible, although tending to require a more complex mechanism—here there is scope for the experimentally minded!

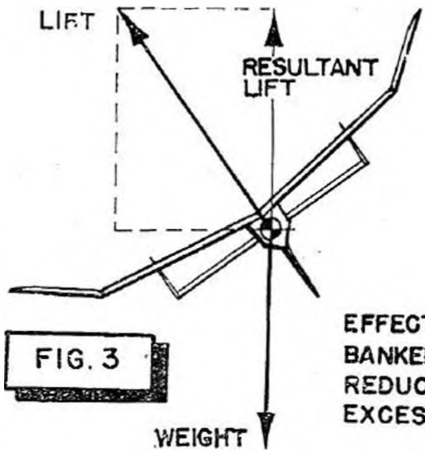


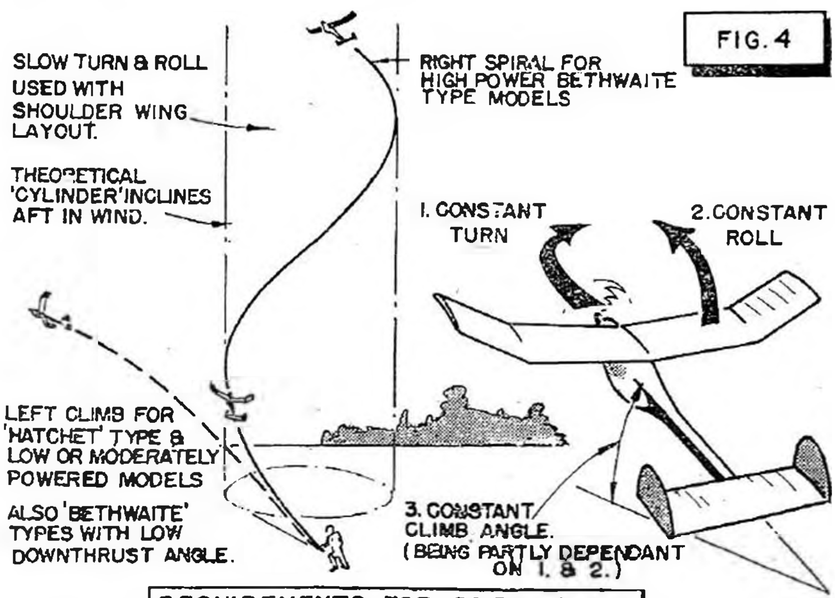
FIG. 3

EFFECT OF A BANKED TURN IN REDUCING EXCESS LIFT

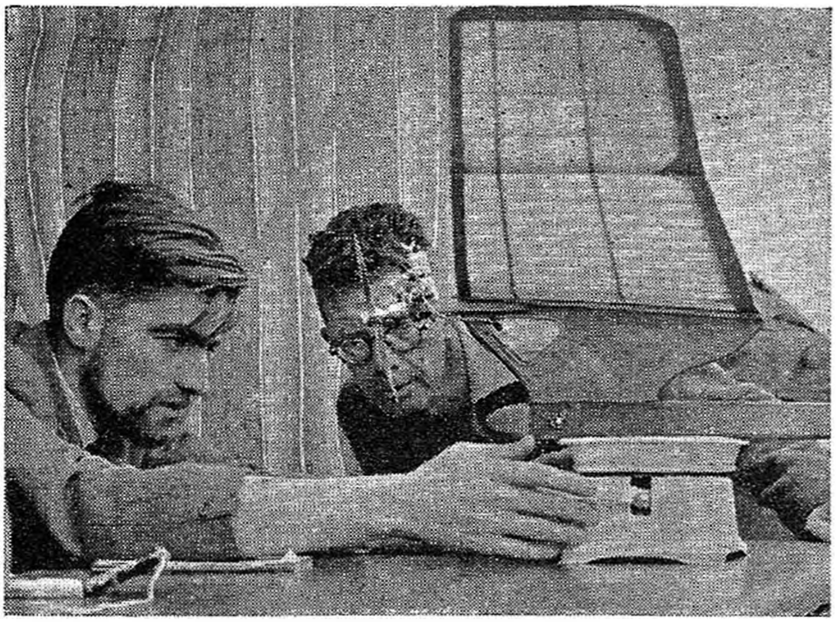
If turn is to be used to any extent in order to prevent looping—see Fig. 3, it becomes necessary to *apply* a roll, that is, use increased incidence on the wing on the inside of the turn, and/or decreased incidence on the outer wing. Using applied turn and roll in this manner it is possible to trim out moderately powered models with no downthrust at all, any increase in power then calls for a further increase of this turn and roll, which only results in both a touchy and not very efficient climb, also the increased warps required will upset the glide trim. Again it must be remembered, that increasing lift on a wing half by increased incidence will also give an increase in drag, to an extent depending on the aerofoil and its lift/drag characteristics. At speed, lift will be predominant, but the increase drag of that wing may then require a reduction in the applied turn, which the drag partly replaces. If wash-in and wash-out are used to the extreme, this may even require use of opposite side thrust.

As an overall consideration it is also good practice to keep wing aspect ratio on the low side, and if possible, as mentioned earlier, use wing taper in order to assist rapid "roll-out".

Power-turn may be applied by sidethrust or *very small* rudder tabs, but whichever method is used, accuracy of adjustment is essential, with either of these some other means of obtaining glide circuit is necessary, such as tailplane tilt or auto-rudder, while if wing warps are being used, these will induce circling on the glide: wash-in (increased incidence) acting as a drag force at low speed, wash-out having the opposite effect.



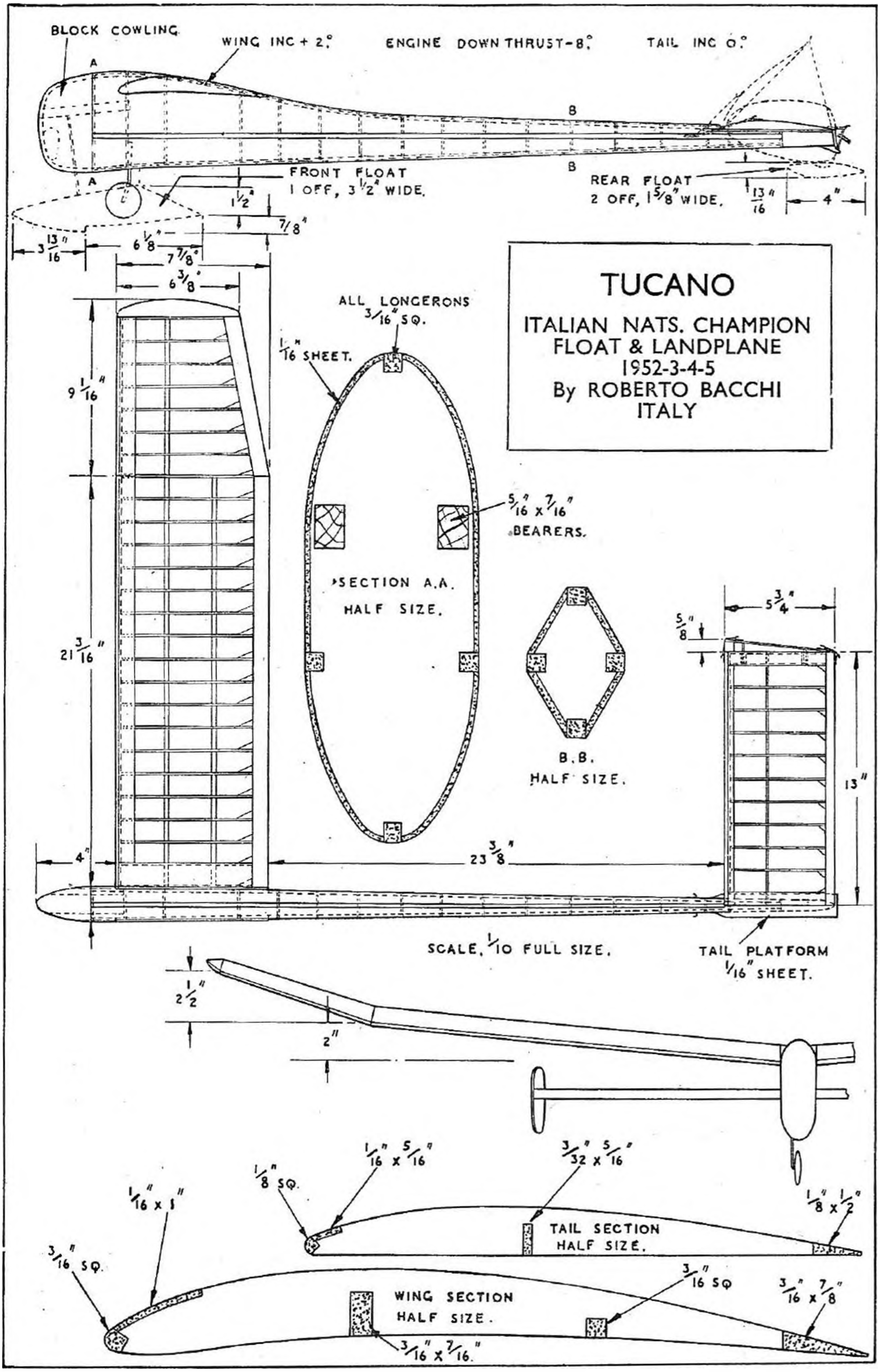
REQUIREMENTS FOR SPIRAL CLIMB



Engine atop of the pylon is shown on this model by Archer of Cheadle. Note downthrust and incorporated tank

Summing up then, the safest approach with all types of high-thrust line model is to use a combination of downthrust (or its equivalent), applied turn, and applied roll, that is using the downthrust initially, and only applying a sufficiency of turn and roll in order to finally cure the looping and achieve a spiral climb. Only three constants are required for a spiral climb (turn roll and climb angle), and as shown in Fig. 4 the model is best visualised as ascending helically round a "cylinder". The steeper the climb angle, the smaller the "cylinder" diameter, and the slower the turn and roll required to hold it in that "cylinder". Similarly, the faster the climb, the more delicate does this balance become. No attempt should, however, be made to emulate the fast turning and rolling climb obtained with pylon models, even when using applied roll; about 1 to 1½ turns for a 15 sec. motor run being quite adequate for stability with even the fastest climbing model. Also this more direct flight path does mean a more efficient type of climb, and one that is less likely to be affected by turbulent conditions.

As a conclusion, it could be offered that the increased care which might seem required when trimming these models, makes them a less worthwhile proposition compared with their pylon counterparts. Be that as it may—there is an awful lot of latitude (and room for good and bad flying) with pylon models, but at a time when most contest power models look each very much the same as the next, there is a place for more originality, it is also a fact that there *are* potentialities of greater performance and consistency in models *without* pylons.


BLOCK COWLING
WING INC + 2°
ENGINE DOWN THRUST − 8°
TAIL INC 0°
A
B
FRONT FLOAT
1 OFF, 3 1/2" WIDE.
REAR FLOAT
2 OFF, 1 5/8" WIDE.
TUCANO
ITALIAN NATS. CHAMPION
FLOAT & LANDPLANE
1952-3-4-5
By ROBERTO BACCHI
ITALY
ALL LONGERONS 3/16" SQ.
1/16" SHEET.
5/16" x 7/16" BEARERS.
SECTION A.A.
HALF SIZE.
B.B.
HALF SIZE.
SCALE, 1/10 FULL SIZE.
TAIL PLATFORM
1/16" SHEET.
1/16" x 5/16"
1/8" SQ.
3/32" x 5/16"
TAIL SECTION
HALF SIZE.
1/8" x 1/2"
1/16 x 1"
3/16" SQ.
WING SECTION
HALF SIZE.
3/16" SQ
3/16" x 7/8"
3/16" x 7/16."

TROUBLE-SHOOTING CHARTS

STARTING point in trimming any new model for flight is a thorough check over of alignment and balance of the assembled machine. The workshop is the logical, and the most convenient place to carry this out and many a model would have been saved the ignominy of a crash on its very first flight if this basic procedure was more commonly followed. An experienced modeller can generally check the alignment of wings and tail surfaces by eye. Viewing the assembled model from the *rear* will show up any warps as well as any tilt on the tail or fin relative to the wings and fuselage. Any component which is slewed out of line, or tilted, will induce a turning effect and uncontrolled turns which develop into spiral dives are the cause of most crashes.

The balance point of the model is important, but not all that critical. On modern model plans, the design balance point is indicated. Failing any such information, a good general rule is to balance cabin, high-wing and similar designs at about one third of the wing chord; and pylon or high-cabin designs at the mid-chord position. Particular care is needed in the case of power models built from American plans where the motors specified for the original design may be very much lighter than the British motor used on the counterpart. It is as well to check this point before building the fuselage and make any necessary adjustment to nose length to arrive at a similar balance point with the finished model.

With few exceptions, models invariably tend to come out tail heavy, especially those built as duplicates of contest-type designs. This is largely due to the fact that the first-class contest man selects the weights of his woods most carefully and invariably uses light, but rigid, stock for the tail components. Nose ballast to trim, however, is not necessarily detrimental and is often to be preferred to "taking up" the trim by increasing the positive incidence of the tailplane, as this reduces the stability margin of the design.

The art of trimming a model out to give its best performance cannot fully be described in words. But there are a certain number of basic rules and actions which must be followed and common faults which must be looked for and corrected. The trouble-shooting charts which follow, cover trimming technique in as wide an aspect as possible and, being in condensed form, are designed for quick and easy reference. The design of the model itself also plays its part—but not such a big part as many people imagine. The main answer to producing a *flying* model lies in trimming.

HIGH-START LAUNCH
Model is towed up dead into wind, using an inextensible line—100 ft. for practice. 169 ft. for contests.

PRE-CHECK

HAND-GLIDING
Choose calm evening with little or no wind. Launch over long grass or similar soft surface. Remove propeller on power models.

TOW-LAUNCHED GLIDER TRIM

Action	Result	Remarks
Run forwards, towing model, adjusting running speed for steady climb. Avoid excessive towing speed. In winds, keep tension in line low, moving *towards* model, if necessary.	(i) Model pulls off to one side.	(i) May be due to one or more of the following faults: (*a*) Model not adjusted for straight flight—correct with fin, or remove warps. (*b*) Towhook too far back—move forwards. (*c*) Model out of line with wind. (*Note:* a stable model will tend to line itself up with the wind direction and then tow straight.)
	(ii) Model weaves to one side and then the other.	(ii) (*a*) Towhook too far forwards—move back. (*b*) Balance point too far aft. Re-trim glide with extra nose ballast.
	(iii) Model will not reach a good height on the line.	(iii) (*a*) Towhook too far forward—move back. (*b*) Line too heavy.
	(iv) Model slips off the line under tow.	(iv) Towhook probably too short, or too far back.
	(v) Model stalls off line.	(v) On way up—as above; at top of launch—excessive towing speed and premature release.
	(vi) Glide on release too straight.	(vi) Use auto-rudder to give required glide circle.
	(vii) Model goes into a spiral dive on release.	(vii) Released in a turn with excessive speed. Glide trim critical—move balance point forwards and re-trim.

HAND-LAUNCHED GLIDE TRIMMING

(i) Check Balance Point	(i) Add ballast or shift wing to conform to plan.
(ii) Check wing and tail rigging incidences against plan.	(ii) Adjust with packing, if necessary.
(iii) Check for warps or mis-alignment.	(iii) Correct warps by steaming out or twist-true when held in front of an electric fire. Use keys where possible to hold positive alignment.

Action	Result	Remarks
Launch with a forward throwing motion directly into wind (if any) from shoulder height. Aim at a point on the ground, 6-8 paces in front. Launch model with wings level, nose slightly down and at approximately correct flying speed.	(i) Model noses up, then falls into a dive.	(i) Overelevated (stalling): apply *one* of the following corrections: (*a*) Move wing back ($\frac{1}{4}$ in.), or (*b*) Add ballast weight to nose, or (*c*) Pack up T.E. of wing ($\frac{1}{16}$ in.), or (*d*) Pack up L.E. of tailplane ($\frac{1}{16}$ in.).
	(ii) Model falls to the ground.	(ii) Most probably a faulty launch (insufficient flying speed), but may be over-elevated.
	(iii) Model turns sharply to one side.	(iii) Possibly due to launching out of line with wind. If not, fin is offset or model out of alignment. Remove warps or counter turn by straightening fin.
	(iv) Model noses down into a steep glide or dive.	(iv) Underelevated (diving): this trim will also aggravate (iii). Apply *one* of the following corrections: (*a*) Move wing forwards ($\frac{1}{4}$ in.), or (*b*) Pack up leading edge of wing ($\frac{1}{16}$ in.), or (*c*) Pack up trailing edge of tail ($\frac{1}{16}$ in.), or (*d*) Re-position weights to move balance point farther aft.
	(v) Model glides straight and flat, covering 6-8 paces before touching down.	(v) Trim substantially correct fine trimming only required to finalise.
	(vi) Model glides slow and straight, with a slight undulating tendency.	(vi) A very good duration trim, but may produce stalling under power tests. Leave as it is for rubber and glider models.

RE-CHECK GLIDE TRIM FROM HIGH-START LAUNCH

	Action	Result	Remarks
FINAL GLIDE TRIM	Launch model on short, half-power run ($\frac{1}{4}$-$\frac{1}{3}$ turns on rubber model) or from 75-100 ft. towline (gliders).	Type (v) glide above may show up as underelevated.	Duration Models: Trim until glide is on point of stall, then add enough turn to iron out into a smooth, circling glide.
		Type (vi glide above may build up into a series of ever-increasing stalls.	Duration Models: Adding turn will usually damp out the stall. Alternatively—treat as overelevated. *Note:* For fine trimming, apply methods (*b*) or (*c*) above, with $\frac{1}{32}$ in. packing at a time.
		Flat, straight glide.	Best for radio control models.
		Flat, wide circling glide.	Best for sports type models.
	Once final glide trim is arrived at, cement in all packing and do not re-adjust		

RUBBER MODEL TRIM

	Action	Results	Remark
PRELIMINARY GLIDE TRIM	Establish as described in Hand-launched Glide Chart		
FINE GLIDE TRIM	Fit temporary downthrust packing of $\frac{1}{16}$ in. Glide Chart and fly model on $\frac{1}{3}$-$\frac{1}{2}$ turns.		Establish best trim as in Re-check
POWER TRIM	As above, working up in stages to 90% maximum turns.	(i) Nose-up, stalling tendency.	(i) (*a*) Add right sidethrust ($\frac{1}{16}$ in. maximum to make model circle right and counteract stall. (*b*) Add more downthrust if stalling persists.
		(ii) Model flies straight and fast.	(ii) (*a*) Excessive downthrust—remove some. (*b*) Insufficient wing incidence—increase, re-trim glide and start again.
		(iii) Model spiral dives to right.	(iii) (*a*) Excessive sidethrust. (*b*) Too much downthrust with sidethrust used. (*c*) Fin offset too much to right.
		(iv) Model circles left.	(iv) (*a*) Insufficient sidethrust. (*b*) Fin offset to left, or wings or tail warped.
		(v) Model flies slowly and does not climb.	(v) (*a*) Lack of power or propeller pitch too high.
		(vi) Model loses height over latter part of power run.	(vi) (*a*) Insufficient power. (*b*) Excessive downthrust: re-trim with less and more sidethrust. *Note:* This effect is sometimes unavoidable with folding propeller models.
		(vii) Power run very short (full turns).	(vii) (*a*) Motor too short. (*b*) Propeller pitch too low. (*c*) Motor too powerful—reduce number of strands.
GLIDE TRIM		(i) Glide circle altered by power trim.	(i) Adding or decreasing sidethrust will generally affect the glide circle with freewheeling propellers. Re-adjust turn, as necessary. Tilting the tailplane is most effective.
		(ii) Stall develops on the glide.	(ii) A common fault with folding and feathering propellers. Increase tailplane positive incidence ($\frac{1}{32}$ in.) and re-trim glide.
		(iii) Model reluctant to circle on glide.	(iii) Use tailplane tilt to adjust glide circle. Trim tab on fin is frequently ineffective.
		(iv) Poor duration.	(iv) Power and propeller being matched and power trim satisfactory, this is nearly always due to an underelevated glide trim.

RUBBER MODEL TRIM

	Action	Result	Remarks
THE RUBBER MOTOR	Always lubricate rubber motors with castor oil or a soft soap lubricant. Break-in before inserting in model. Keep free from grit, etc. and do not expose to sunlight.	(i) Motor breaks. (ii) Strand(s), Break(s). (iii) Motor lacks power. (iv) Motor bunches or climbs round shaft.	(i) (*a*) Overwound. (*b*) Old motor. (*c*) New motor, not properly broken in. (*d*) Faulty winding. (ii) A not uncommon happening Repair by re-tying strand unless the motor is old. but check that motor is not cut on hooks fittings etc. (iii) Old, fatigued motor—replace. (iv) (*a*) Fittings faulty—use bobbins and/or "S" hooks. Bind ends of motor with rubber band. (*b*) Faulty winding technique.

POWER MODEL TRIM

	Action	Result	Remarks
PRELIMINARY POWER CHECK	Throttle back engine or use prop reversed to reduce thrust. Launch with 10-sec. motor run. (Increase to full power)	(i) Model stalls or goes into a loop. (ii) Sharp bank to left or right. (iii) Fast, straight flight, shallow climb.	(i) (*a*) Add downthrust. (*b*) Add positive to tailplane and move balance point aft to re-trim glide. (ii) (*a*) Check for wing warps or fin offset. (*b*) Counteract with opposite sidethrust (iii) Try with increased power. If good climb does not develop— (*a*) Reduce downthrust. (*b*) Try different propeller sizes for increased thrust.
FULL POWER TESTS	(Increase to full power)	(iv) Circling climb.	(iv) Try with increased power. Pylon models should circle *right*, cabin models *left* for maximum safety.
	Increased power.	(v) Power circle tightens up.	(v) Reduce turn, as this may lead to a spiral dive— (*a*) By sidethrust adjustment; (*b*) By *slight* opposite fin offset. (*c*) By tilting tailplane; (*d*) By reducing downthrust. One complete turn in 10 secs. is a good trim for a high-powered contest model.
		(vi) Model loops.	(vi) (*a*) or (*c*) above to induce turn. Added downthrust can also be used, but this may be dangerous allied to any natural turn.
	Power-Glide transition.	(i) Violent stall and loss of height before recovery.	(i) A smooth transition from power to glide can only be achieved by careful trimming. The model must be circling, however wide the radius, when the power cuts.
FLYING	Subsequent flights.	(i) Model starts different turn, or behaves erratically. (ii) Motor lacks power. (iii) Motor cuts prematurely.	(i) (*a*) Surfaces shifted or warped, particularly fin, check that all hold-down bands are strong enough. (*b*) A change of propellers will alter the power on circle if of different diameter or pitch. (ii) (*a*) Incorrect adjustment. (*b*) Stale fuel. (*c*) Motor loose (mounting bolts have slackened under vibration). (*d*) Cylinder or crankcase backplate vibrated loose and leaking. (iii) (*a*) Dirt in Fuel. (*b*) Mixture too lean. (*c*) Incorrect settings. (*d*) Tank badly positioned or fuel line fallen off.

THE DEVELOPMENT OF A SUCCESSFUL RADIO CONTROL MODEL IN NEW ZEALAND

By L. H. WRIGHT

Author Les Wright, pioneer radio control experimenter in New Zealand, who has recently produced that country's first commercial r/c equipment under the famous H.M.V. trademark

IT STARTED in 1936 with the acquisition of a "Baby Cyclone" spark ignition motor and the construction of a 7-ft. free flight model to see what could be done with it. The first flight (no timer) was successful enough, but the landing gave much food for thought—and that thought led to the obvious need for some form of remote control. You see, the model landed without any warning of its arrival in the local farmer's cow pails during "Operation Milk", and the resulting mixture of cows, milk, model and earthy comments from the startled farmer, remain ever fresh in my memory. The farmer's firmly stated opinion that "them things shouldn't be allowed to go flying about any old how" was recognised as pretty logical in subsequent moments of calmer reflection, and being a radio type, I suppose the results were inevitable. Anyway, that was the last free flight model.

This experience started off some initial experimenting and "on bench" circuitry until in 1937, Ross H. Hull, the Editor of the American Amateur Transmitters periodical *Q.S.T.*, made his memorable appeal to the amateurs throughout the world to solve the problem of remotely controlling a model aeroplane by radio. At that time it was a real problem, as I then had sufficient experience to know, and although various individuals had been successful in controlling models prior to that date, the circuits used were extremely critical, and mostly worked only in the hands of their designers. Hull's aim, therefore, was to open up the subject in the hope that some simple and reliable method could be found and he had set the ball rolling by designing a receiver for a 10-ft. sailplane with which some impressive demonstrations had been given.

Looking back, the writer recollects thinking that the problem looked both interesting and reasonably simple, and the challenge was accepted. In the years that followed it at least proved very interesting. It was not, however, without its full quota of discouragement, so before describing the present equipment, let us reminisce and so follow the development of the present system step by step.

History and Choice of Circuit

In order to begin somewhere, Hull's own circuit was built and in 1937 was optimistically installed in a 7-ft. power model. It never worked properly—

at least not when the model was airborne—and this was the forerunner of many others with similar characteristics. Sooner or later they all came to a sticky end. Came a time when there were just not sufficient hours to build replacement planes let alone experiment with temperamental radios. The Gremlins had it too much their own way.

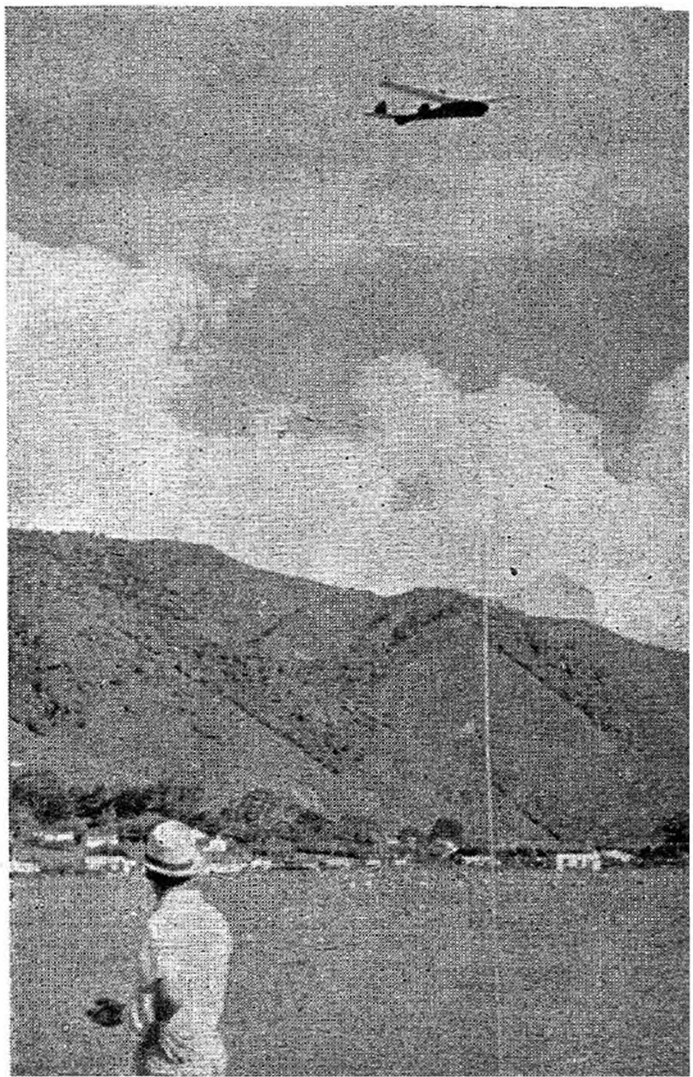
A halt was called and instead of a plane, a boat was used as a test bed. It would at least remain in one piece when the rudder stuck hard over. This boat idea proved to be a very wise decision, as it enabled many unsuspected faults to be detected.

At this stage also, considerable thought was given to the type of receiver to use and instead of jumping from one circuit to another, it was decided to pick out the most promising and concentrate on this, ironing out the bugs one by one. This proved also to be a wise decision.

On reviewing the many circuits available, one very significant fact became apparent. All receivers could be classified into either one of two separate groups, and this general distinction can still be made in equipment used nowadays. The first group consisted of all those receivers that were basically stable and yet were purposely adjusted to a point of instability, so that the transmitter signal would trip them from one condition to another. The second group consisted of inherently stable circuits which operated in this stable condition at all times.

In order to illustrate this distinction, let us invoke a bit of early history and examine a few typical circuits to see how they fit into the above description. Beginning with Ross Hull's. This was a three valve affair with a sensitive relay controlling a rubber driven escapement. Incidentally, this was the first time this method of rudder control had been used, and full credit must be given to Hull for devising such a system. The principle used in the receiver was likewise very ingenious and has only been prevented from more general use because of one apparently insurmountable weakness. In general, use was made of the characteristic hiss of a super-regenerative detector to produce a bias to limit the current in a relay valve to about 1.0 milliamp. Directly a signal was received the hiss was eliminated, the relay current rising to about 3.0 milliamps. This closed the relay and operated the escapement.

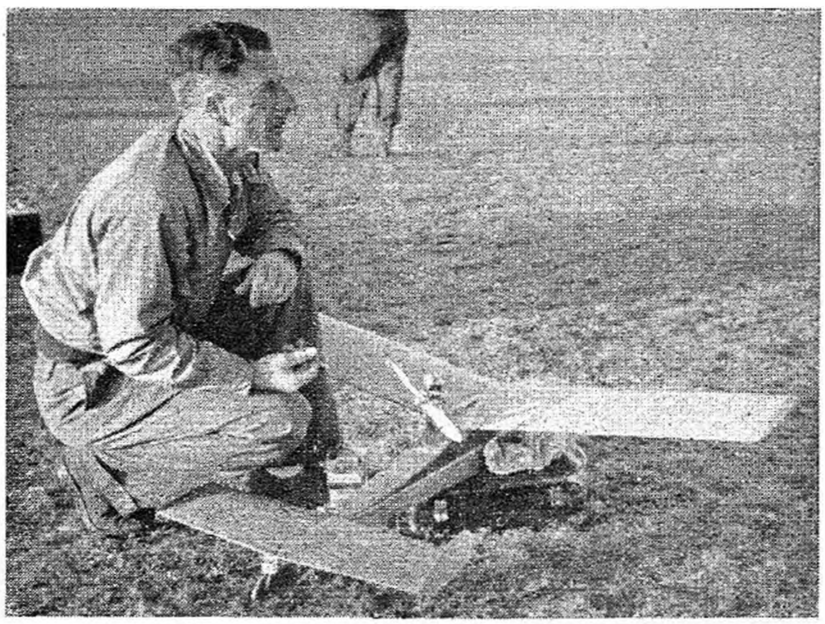
The major weakness in this system, however, was the interference caused by microphonic valves when any sort of vibration was present, and this rules it out for the control of power models. The reader will realise that micro-



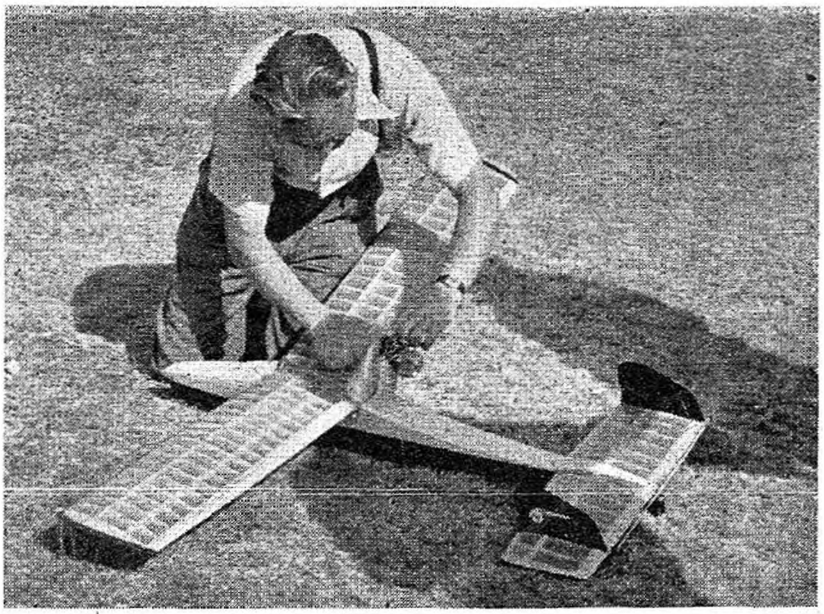
Joe Tomlin flies his R6-B in surroundings and weather typical of New Zealand conditions phonics (the ringing noise produced when a battery type of valve is given a sharp tap) is as much a noise as the super-regenerative hiss, and as the action of the receiver depends upon a noise-free condition when the transmitter is on, all control is lost if microphonics are present.

In 1938 came the success of Walter Good (now Dr. Good, and well-known as the designer of the "Rudderbug") and his brother, by their outstanding demonstration of reliability in winning the radio control event in the American Nationals for three consecutive years. This result was achieved by the correct mixture of personal experience combined with simplicity of equipment.

The receiver used consisted of a type 30 valve working as a separately quenched super-regenerative detector. A variable grid bias control was provided, which at a critical setting produced a current change of about 2.0 milliamps when a transmitter signal was received. Their very simple rubber driven escapement, initiated by a sensitive relay, was the forerunner of the lightweight escapements used nowadays. And finally, just before the war, a special gas triode type RK61 was produced in America. This valve, designed especially for radio control purposes, seemed to be the complete answer and it was subsequently miniaturised into the form so well-known nowadays. Certainly a circuit using this valve called for a variable resistance that had to be periodically adjusted to suit battery and other variations, but its big redeeming feature was the simplification of the circuit. Radio control took a great stride forward when this valve was used. Unfortunately, to my mind, the gas triode has one or two serious limitations. Just to mention one: Due to its relative insensitivity a fairly tight coupling to the aerial is necessary and the most sensitive condition is obtained when the valve is adjusted to a point perilously close to where it ceases to function altogether. This, of course, reduces the tolerances to all the variables encountered on the flying field. In this criticism I may be playing with dynamite, as there must be thousands of modellers who are getting results with the gas triode and to whom this method is the ultimate in single channel control. But these chaps will admit that the variable plate resistance has to be "spot on" for best results and that the correct use of the valve calls for an intelligence just above the average! To my mind, the ideal system is one that requires no adjustments and no radio "know how", and I have always considered this a basic requirement. The gas triode was therefore out. In this brief summary, only three systems have been mentioned. There are many more, but these are typical. On analysing these in the light of our classification, only the first falls into the truly stable group, the others needing an adjustment of some



Alan Rowe with his original R6-B, a design which has become virtually the "standard" radio control model in New Zealand.



Author Les Wright with his R6-B which it will be noted differs in minor details from designer's own version

kind during their normal operation.

This then, was the reason behind the initial choice of circuit, and a start was made to develop a receiver working on the principle of the cancellation of the characteristic noise of a super-regenerative detector on the reception of a C W. signal (continuous wave).

Receiver Circuit Problems

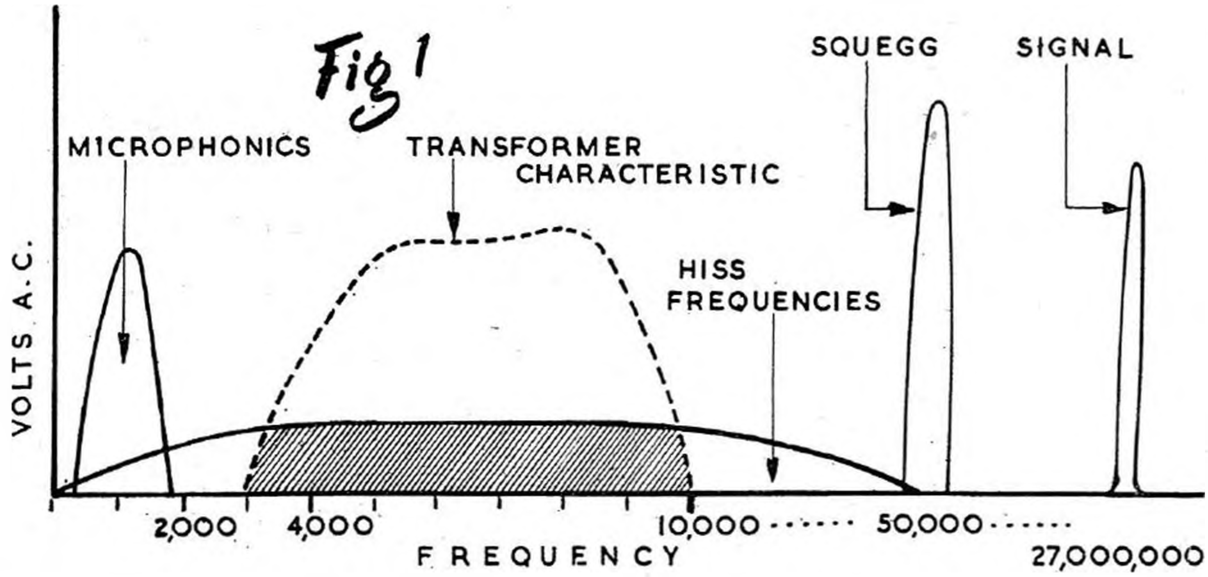
This article is not the place for a highly technical discussion, but if the reasons behind the present receiver are to be understood, a certain amount of radio "know how" is desirable. If the finer points are too difficult, it is hoped that the average reader can understand the following in a general way.

First of all, let us consider the common super-regenerative detector and see what really happens inside the circuit. Incidentally, this type of detector was invented away back before the first world war, but its action was not fully understood until 1938. But this is by the way. A super-regenerative detector is primarily a simple oscillator circuit in which the oscillations are interrupted many thousands of times per second. In this way, the detector is associated with two separate frequencies. The higher is called the signal frequency, and is that which the valve will detect, while the lower frequency is called the squegg or quench and is the number of times the signal frequency is interrupted per sec. In the case of our detector, the signal frequency is 27.12 megacycles per sec. and the quench frequency, being non-critical, somewhere in the region of 50 kilocycles per sec.

In general, there are two ways in which this quench frequency can be produced. (1) by supplying the detector with the A.C. plate voltage from a separate oscillatory circuit. This method is known as a "Separately Quenched" detector, or (2) by using a very high order of feedback to cause the detector to oscillate so violently at signal frequencies that it chokes itself out of oscillation and stops. After a short lapse of time the valve re-adjusts itself and commences to oscillate again, this process repeating itself at quench frequencies. This method is known as a "self quenched" detector.

Any advantages that the separately quenched detector might have are far outweighed by the extreme simplicity and lighter component weight of the self-quenched method, and so the latter method is in general use. When a pair of headphones are connected to a super-regenerative detector that is operating correctly, a characteristic hiss is heard. This hiss is completely eliminated on the reception of a transmitted C.W. signal. Now let us try to explain this effect.

First the hiss. As already explained, there is a period of time during each quench cycle when the detector ceases to oscillate. A fraction of a second later,



ACCEPTED PORTION OF THE HISS FREQUENCIES ARE SHOWN SHADED.

conditions again become favourable and oscillations recommence. The absolute starting point of each burst of oscillations depends upon minute random or stray currents flowing in the valve and coils. It is the irregularities of these random effects that are responsible for the characterised hiss associated with this type of detector.

The reason for the elimination of the hiss on the reception of a C.W. signal is explained by the fact that the valve need no longer rely upon random effects to initiate each series of oscillations, as the transmitted signal, on the right frequency, is there to assist these first movements of current.

So far three separate frequencies have been mentioned, but there is yet another with which we have to contend, and this is the one that caused so much bother in early experiments. Reference was made earlier to the microphonic nature of some battery valves when subject to vibration. These microphonics, primarily caused by vibration of filaments and other electrodes, have a frequency between 500 and 2,000 cycles per second depending upon the valve structure.

Summarising, we now have four frequencies:—

(1) **Signal Frequency** at 27.12 meg. cycles per second.
(2) **Squegg Frequency** at approximately 50 kilocycles per second.
(3) **Hiss Frequencies** which are in the nature of a broad band extending from zero to the squegg frequency.
(4) **Microphonic Frequencies** varying between 500-2,000 cycles per second.

Reference to Fig. 1 will show the whole position in a graph form. The diagram is purely graphic and does not pretend to show actual spacing between the four frequencies. These conditions exist in a super-regenerative detector which is in a receptive condition and with vibration present, e.g. in a model in flight.

Now what happens when a signal is received? The hiss frequencies are immediately stopped, but it is important to note that they are the only ones materially affected by the transmitted signal. The others go merrily on and if we are to make full use of the suppression of this one band of frequencies as our controlling means, we must devise some method of separating this band from the signal, the squegg and the microphonic frequencies sitting on either side.

'et another R6-B in a sized-down ersion built by Mort Glading seen here preparing it for flight.

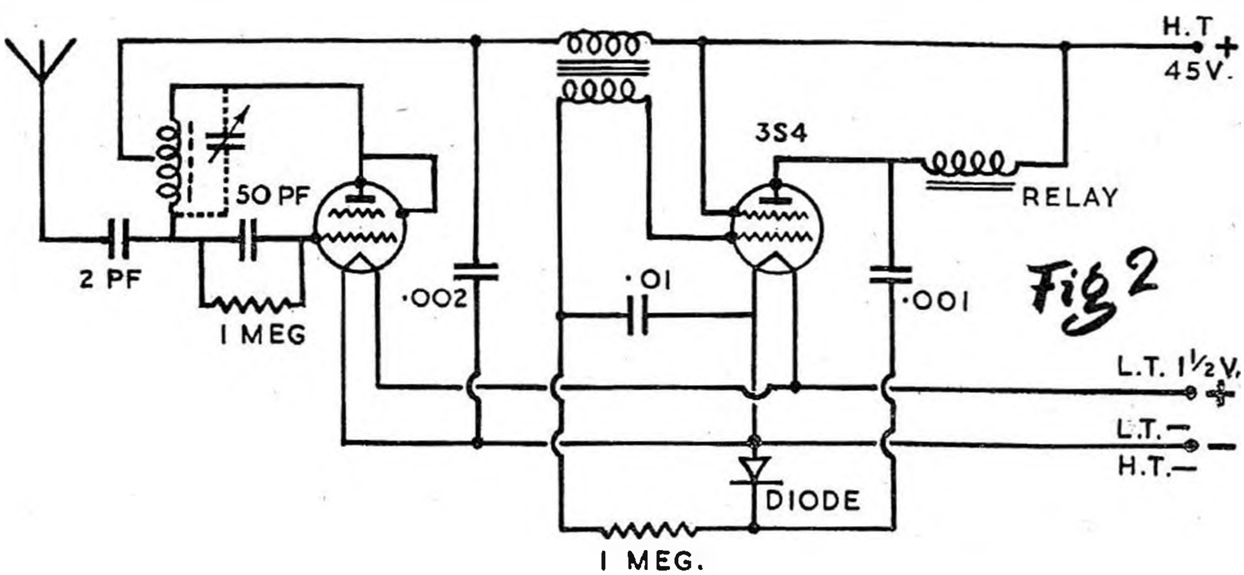
The Receiver

So there's the problem, and let us now discuss one way in which it can be solved. This is the method used in the current equipment.

Fig. 2 shows a self-quenched detector, transformer coupled to a relay valve in the plate of which is a simple reflex arrangement. It will be realised that the several frequencies already mentioned appear as small AC voltages in the plate of the detector, and it is at this point that our first separation occurs. It is well known that a condenser will pass high frequencies more easily than lower ones. The condenser between detector plate and earth will effectually pass the very high signal frequencies so that from here on they can be ignored. Unfortunately, the amplitude of the squegg frequency combined with its closeness to the wanted hiss, precludes the possibility of separation by condenser alone. Likewise, the microphonics, being lower than the wanted frequencies cannot be disposed of by a parallel condenser. A series condenser could possibly be used, but the diagram shows the only practical answer to the problem—transformer design.

This transformer, although only a small component, is the heart of the system and the key to the problem. Weighing less than one ounce it will only pass frequencies between well defined limits. Roughly resonant at 6,000 cycles, it effectively rejects all frequencies below 3,000 cycles and above 10,000 cycles per second. Moreover, this component not only separates the wanted band, but also provides a measure of voltage gain at the same time.

Returning to the circuit, these frequencies having been selected, they



are passed to the grid of the second valve and appear as amplified AC voltage across the relay in its plate circuit. This relay, being a DC operated device is not affected by the AC voltages. From the plate these voltages are now passed through a condenser to a diode where rectification takes place. The negative DC potential so produced is then fed through a resistance and the transformer secondary, to the grid of relay valve, where it controls and limits the DC current flowing through the relay. Thus the relay valve is being used to produce its own grid bias from the frequencies passed by the transformer.

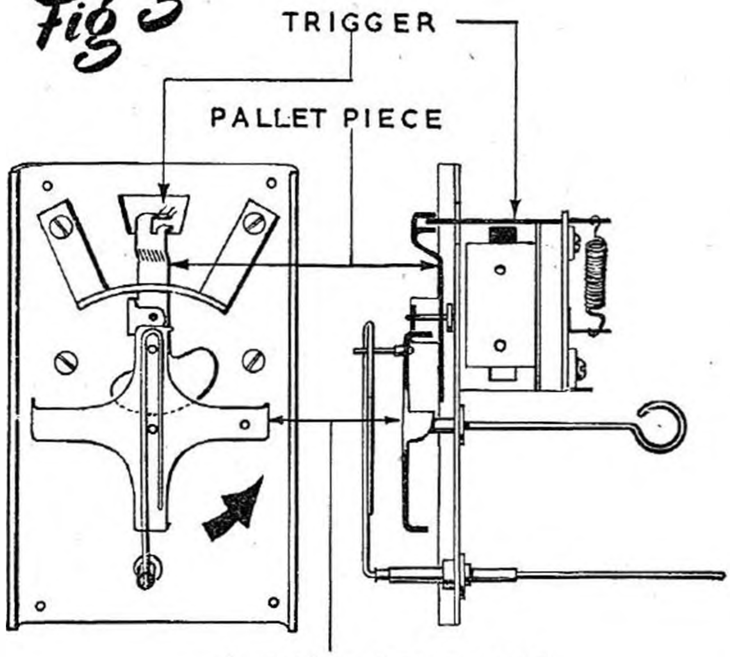
Now—when a signal is received, the hiss is eliminated and the grid bias reduced, with a corresponding rise in relay current. In actual practice, the idling plate curent is $\frac{1}{2}$ milliamp which rises to 9 milliamps on reception of a signal. This relatively large current resulted in a marked improvement in reliability against all other methods where a smaller current change was produced. No longer was any critical relay adjustment necessary, and a sturdy relay could be rigidly mounted and the contacts more or less permanently sealed against exhaust fumes, dirt, etc.

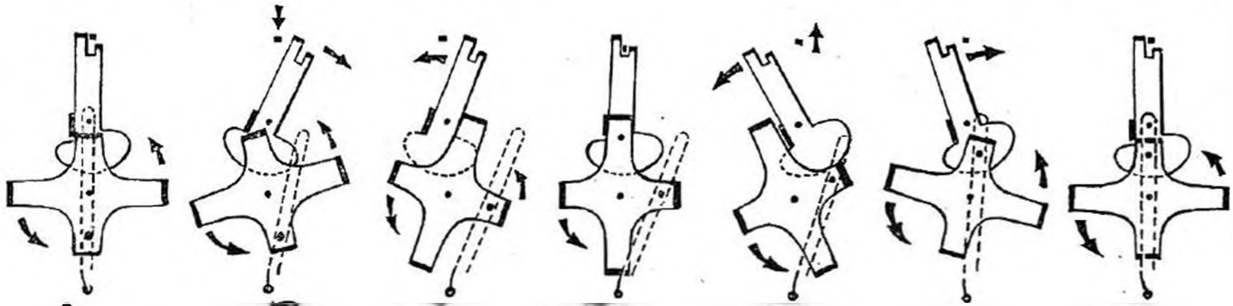
The Relaytor

So far I have spoken of the use of a normal relay in the circuit, and this was in fact used while earlier receiver experiments were being carried out. However, it soon became apparent that many of our troubles in the field were directly attributable to the relay which at best was only an intermediate step in the control process. Consideration of the healthy current change available, logically led to thoughts about the elimination of this middleman—and so after negotiating the usual pitfalls, came the Relaytor, so named because it combines the functions of relay and actuator. This operates directly from the receiver with no intermediary relay.

First thoughts were not actually very encouraging as a few calculations soon showed that the receiver power available to operate the escapement was hopelessly

Fig 3





'RELAYTOR' ACTION SHOWING HALF CIRCLE

inadequate when compared with the power taken from normal escapement batteries and controlled by a relay. This power is rated at so many ampere-turns on an electro magnet and only about 1/10 of the required amount was available.

However, turning the problem round the other way, it could be made sufficient if the energy required to trip an escapement could be reduced to something comparable with the actual power available. Basically, the force required is only that necessary to overcome friction at the release points. So remembering that one can lift a far greater weight by using a crowbar than by applying direct force, an intermediate mechanical advantage was introduced to step up by means of leverage, the power available from the receiver.

Reference to Fig. 3 will show that the relaytor in its final form uses the armature as a trigger to trip off a rubber powered four star selector wheel through the movement of an intermediate pallet piece so giving the usual left neutral right neutral sequence. No adjustment in operation is required. There is no wear at the escapement wheel stops as not only are these all square faces of large area where they are in direct contact, but also the actual impact force is reduced because of the intermediate pallet piece stage.

The Result

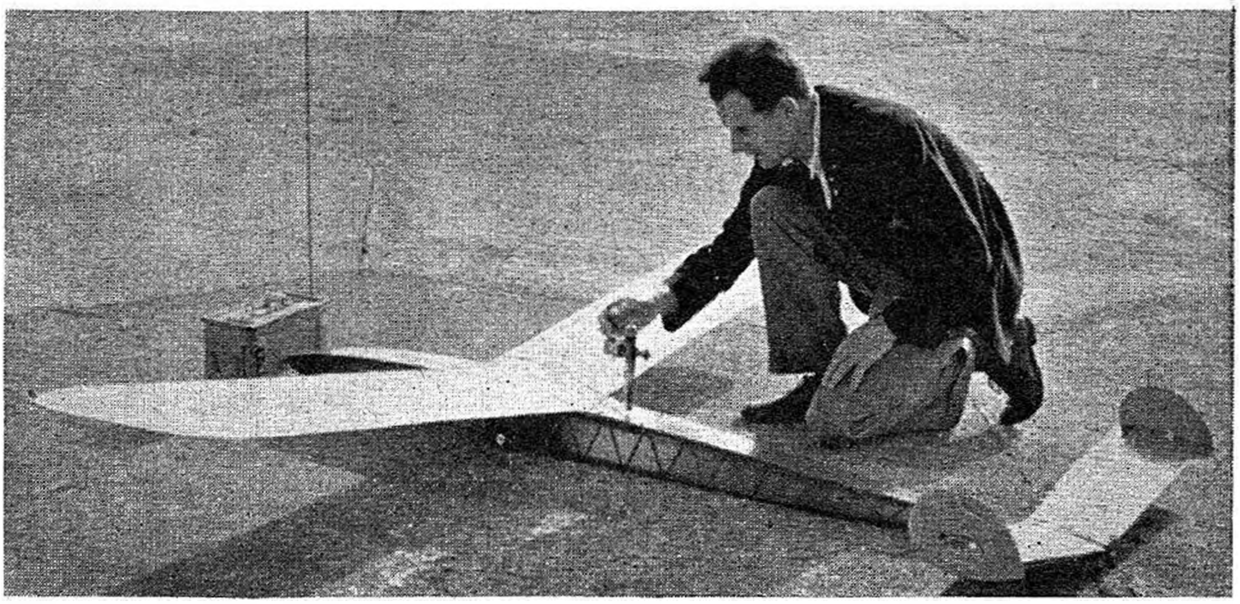
The current equipment then, consists merely of a receiver in a strong fibre case, a relaytor, a $1\frac{1}{2}$ volt L.T. battery, and a 45 volt H.T. battery.

There are no vibration problems and the receiver is mounted firmly in the model free from the hazards of rubber suspension. Current practice is to merely surround this unit with a small amount of rubberised horsehair packing to prevent inertia damage in the event of a violent crash. There are no operational adjustments after one initial tuning check so that all equipment can be built in as permanently as desired.

The net result is freedom to concentrate on pure aircraft problems with no necessity for any fuselage access other than for battery replacement and relaytor rubber winding. Fuselages need be no wider than the receiver casing.

Radio control equipment has thus become like the modern motor, something to be installed and forgotten—almost in the "necessary evil" class.

Frank Bethwaite with his power assisted glider which has achieved widespread fame for its part in establishing world radio control duration records, getting N.Z. on the F.A.I. World's Records List for the first time!



C.G. POSITION

THE TERMS balance (point) and centre of gravity (position) are used synonymously whereas strictly speaking only the centre of gravity is an exact point and the balance point is the position of the centre of gravity relative to the overall length of the model, i.e. the balance point established when rigging the model for flight. This horizontal position of the centre of gravity (i.e. the balance point) is by far the most critical as regards trim. The vertical position of the centre of gravity is normally ignored entirely, although it can in actual fact play a considerable part in trim.

It is perfectly possible to fix the balance point over a very wide range and still trim the model out to fly successfully. It is also possible to ignore the question of where the model balances and adjust the trim entirely on the reactions produced by test gliding. This latter method, however, can fall down if the original balance point was not in a reasonable position; can lead to a lot of time arriving at a final trim without any guarantee that it is the *best* trim which can be achieved; and may also be extremely hard on the model during the "proving" trials.

The first point to be considered is that the angle at which the wing is mounted on the model is purely an arbitrary setting. Trimmed for an "optimum" glide, the wing will be operating at an angle of attack quite near its stalling point—say 6 to 7 degrees. The main significance of the wing rigging angle is that it affects the *attitude* which the rest of the model will assume relative to its flight path.

With most orthodox wings, the point of application of lift at such a flight attitude will be between 25-30% of the chord—the root chord in the case of rectangular wings*, or the mean chord in the case of tapered or swept wings—Fig 1. The other force to be considered from the point of view of establishing balance is the total drag force—the resultant of wing drag, fuselage drag, etc.—Fig. 2. If this has a moment about the ultimate centre of gravity position it will have to be corrected when establishing trim by means of the two variables—the balance point and the tailplane setting.

Take first the case where the drag force comes in line with the centre of gravity and thus produces no pitching effect. The balance point can then be located in any of three typical positions—forward of the centre of lift (1), immediately under the centre of lift (2), and aft of it (3). Only position 2 is an exact setting. Either of the other two can be varied over a wide range.

To balance out in case (1) the tailplane must be rigged to develop a downward force, which is obviously an inefficient arrangement and never used on free flight models. In position (2) the tailplane is used purely as a stabiliser, rigged to give no lift when flying in trim and only effective as a working aerofoil

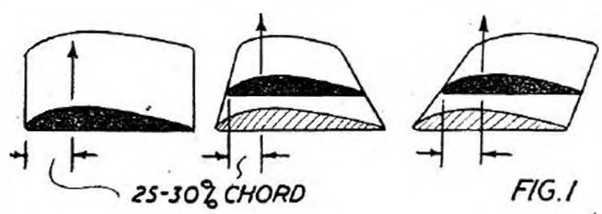


FIG. 1

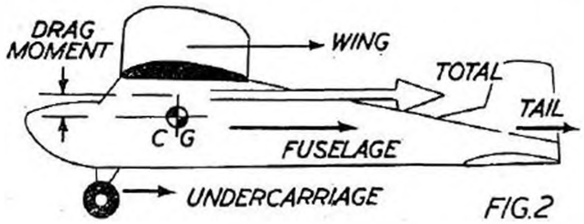
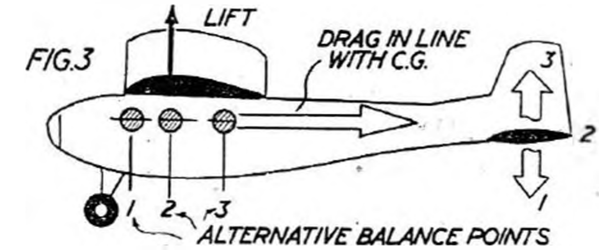
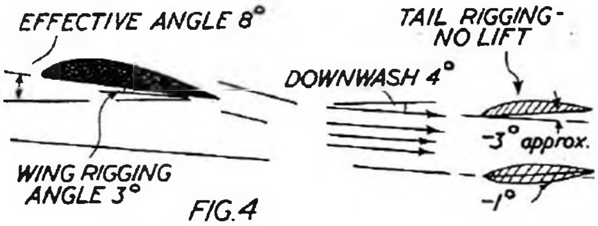


FIG. 2

* Strictly speaking, CG. position should be related to mean chord on all wing layouts. Adding incidence to a rectangular wing, for instance, imparts sweepback. The difference is small enough to be ignored and centre of pressure position in any case only an affirmation.



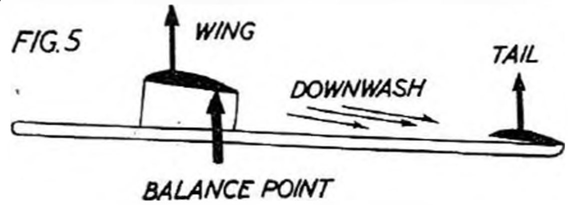
when the model is displaced from its normal flight path. Correctly speaking, this is the only definition of a "non-lifting" tailplane and has no reference to the tailplane *section*. The section can be symmetrical or cambered, in both cases rigged to generate no lift in normal flight.

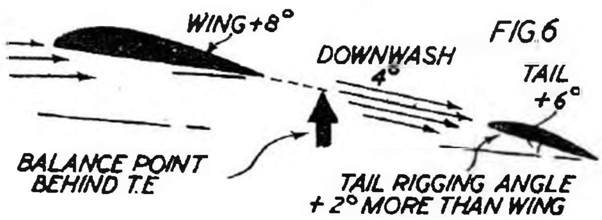


Such a balance point is an extremely stable one for it enables the tailplane to be used with maximum efficiency as a stabiliser with a generous effective longitudinal dihedral angle or difference in angle of attack between wing and tail. The *effective* longitudinal dihedral is not merely the *geometric* difference between the two rigging angles, which is apt to cause some confusion. Suppose, for example, the wing is rigged at 3 degrees incidence and its actual operating angle of attack is 8 degrees. Downwash from the wings will modify the airflow over the tail, equivalent with a conventional moment arm length to an effective displacement of the airflow through roughly half the angle of attack of the wings, i.e. 4 degrees. The tailplane must be lined up with this deflected airflow, giving an apparent angle of attack of 4 degrees with a symmetrical section and in the region of 2 degrees with a cambered section—Fig. 4. Translating this back in terms of actual *rigging* angles, with the wing at plus 3 degrees this corresponds to a tailplane rigged at —1 degree (symmetrical section) or —3 degrees (cambered section). It is instructive then to work out the effective angle of attack of the tailplane and thus its corresponding corrective power), when the model is displaced nose-up or nose-down, following the same principle.

Adopting the third balance position (3) means that equilibrium can only be produced by rigging the tailplane to develop a continuous upward force. In other words, a lifting tailplane is utilised, contributing towards the total lift and thus serving a dual purpose—Fig. 5. Almost all duration models are rigged in this way, the actual balance point adopted ranging from just behind the centre of lift back to beyond the trailing edge. But the more one tries to utilise the tailplane as a source of lift (i.e. the farther aft the corresponding balance point), the less the efficiency of the tailplane as a *stabiliser,* simply because of the reduction in effective longitudinal dihedral.

To take an extreme case, with the same wing operating angle of attack as before and an *effective* angle of attack for the tailplane of 6 degrees, the tailplane would have to be rigged at a 2 degree positive angle *greater* than the wing rigging angle—Fig. 6. With a moment arm of about 4 time the wing chord and a 40% tailplane, this would correspond to a balance point about half a chord length *behind* the wing trailing edge.





Although a perfectly feasible arrangement, the stability margin of such a layout is low and, in fact, non-existent in a nose-down displacement. This is because any lowering of the effective angle of attack of the wings (such as dipping the nose after a stall) immediately reduces the downwash and *increases* the effective angle of attack of the tailplane. Such a model would then have no recovery from a dive.

The practical limit with aft balance trim is generally realised with long moment arm models (which has the effect of lessing the downwash effect because of the greater distance of the tailplane from the wing) with a 1 to 2 degree *rigging* angle difference between wing and tailplane and the balance point on the trailing edge or up to one third of the wing chord behind. Even so, dive recovery is usually very poor and a high drag centre essential to help in recovery, i.e. the centre of drag is above the centre of gravity of the model and normally exerts a nose-up couple which increases with increasing speed.

As a general rule, the trailing edge should be considered an aft limit for balance on any duration model and adopting a minimum *rigging* angle of difference between wing and tailplane of 1 to 1½ degrees is a safeguard against a reversal of stabiliser action should the model adopt a nose-down attitude. The lower the wing position the smaller the safety margin and a 75% chord limit is recommended for the balance point on shoulder wing designs. Shoulder wing power models are very prone to fly "over the hump" with an extreme aft balance trim and dive in under power.

An important point to bear in mind with all power models is that the flying speed is higher under power, meaning that the angle of attack of the wing is lower and with it the wing downwash, increasing the effective angle of attack of the tailplane. The pylon layout largely offsets this by the increased drag couple at higher speeds, which is one of the main reasons why a pylon layout is so much favoured for high-power duration designs. On the other hand, to increase the stability of any model the balance point should be moved forwards (retrimming the tailplane setting to leave the *wing* operating angle of attack unchanged). But the pylon model tailplane is now less effective in combating the looping tendency of the drag force and so seldom is a very forward balance point employed on such layouts. A figure of between 60 and 75% of the chord is about average for contest standard designs.

Moving the balance point forward on a high-powered shoulder wing design usually demands a very large downthrust angle to prevent it from looping. It has been recommended, and it seems to work out in practice, that with the balance point around 40% of the chord the thrust line should pass above the centre of gravity and it is possible to produce a very effective, fast-climbign trim by this technique.

With rubber models, power-on trim is not so critical but the same general technique applies—balance point fairly well forward (40 to 50%) for shoulder wing or high wing designs; and 60-75% on pylon layouts or up to 100% on pylon designs with long moment arms. Gliders do not represent the same problem as regards "power-on" trim although it is generally found that approaching a "critical" trim by working to an aft balance point position may lead to towline instability. A far better solution here is to utilise as much of the total area as possible for lifting by transferring area from the tailplane to the wing, rather than employing large lifting tailplanes. Large tailplane areas (30 to 50% are normally a characteristic of powered models and necessary for "power-on" stability. Glider tailplane areas can be reduced to as low as 15-20% without resorting to excessive moment arm lengths, when a balance point of 40 to 50% of the chord is generally a satisfactory solution.

AEROFOIL CHARACTERISTICS

THE SIMPLEST form of aerofoil is a flat plate which, for small model sizes, is also quite efficient—not because the flat plate itself is an efficient aerofoil (in actual fact the reverse is true), but because in very small sizes and at low speeds all aerofoil sections tend to become relatively inefficient. It is normally reckoned, in fact, that if the chord of an aerofoil is less than 3 in. the actual shape of the section will have little effect on performance and all shapes will tend to have similar or "flat plate" characteristics.

This is not necessarily true in all cases, but it does emphasise that in model sizes differences in the shape and form of aerofoils may not give very great differences in performance, which accounts for the apparent "failure" of many highly developed model sections and the undoubted success of many sections simply drawn "by eye", or in some cases merely formed by sanding from rectangular strips assembled as ribs when making the wing!

At the same time, however, there are definite types of sections best suited to certain classes of models. Well cambered sections are generally admitted to be best for glide performance; a fairly thick symmetrical wing will transform an indifferent control line stunt model into one which will "go through the book", and so on. Hence a working knowledge of basic aerofoil characteristics is a great help in selecting the best type of section to use for a particular design. Which individual section of this type is used is then largely a matter of personal preference.

Outside the "flat plate" range mentioned, forming the flat plate into a curve produces a better aerofoil, the reason for which can be quite simply attributed to the fact that the curved plate deflects the airflow through a greater angle and therefore develops a greater aerodynamic reaction—Fig. 1. The geometric form of the curved plate can be expressed in terms of the amount of curvature or *camber* (B) and the position of the point of maximum camber from the leading edge (A). Normally both A and B are expressed as a percentage of the chord length (C).

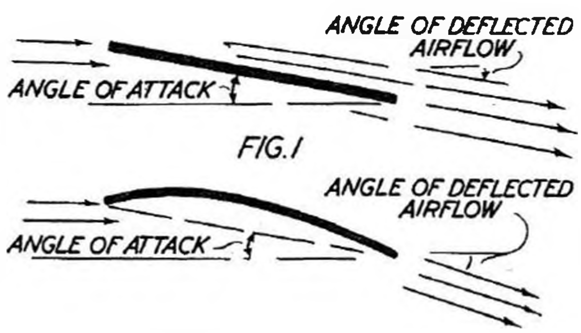


FIG. 1

Increasing the camber (A) has the effect of increasing the amount of lift at low angles of attack besides increasing the maximum lift, as well as also increasing drag. The curved plate aerofoil will also generate a certain amount of lift at zero angle of attack whilst the angle of attack for *minimum* drag is higher than that of a flat plate or non-cambered aerofoil. This latter case mitigates against the use of cambered sections for high speed aircraft, but is relatively unimportant for model work except for speed models or models which normally fly with the wings at a low angle of attack.

The position of the maximum camber (A) is rather less marked in effect. Moving A forward tends to give the aerofoil a wider lifting range (i.e., increase the negative angle which of attack at lift becomes zero), but is

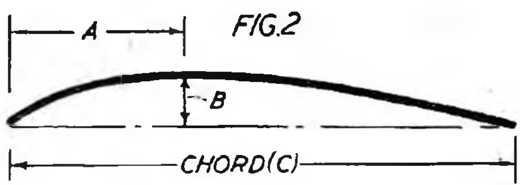


FIG. 2

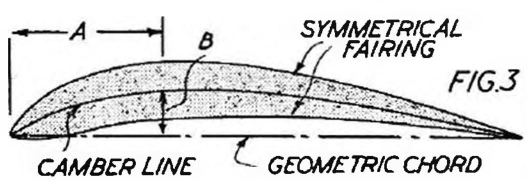


FIG. 3

rather more important as a characteristic in the case of a conventional aerofoil built up by adding a symmetrical fairing to the basic curved plate. A large number of aerofoil series have been produced in this way by adding a symmetrical fairing around a camber line, which introduces a further factor to be considered—the thickness of this fairing—Fig. 3. In related series the basic form of this fairing is the same, the thickness being varied together with A and B values.

As a general rule, for every camber value (B) there is an optimum thickness/chord ratio (T/C). The greater the camber (B), the lower the thickness/chord ratio for best performance. Additionally, the smaller the value of A, the smaller the value of the optimum thickness (T/C).

This implies that heavily cambered sections should be relatively thin, for best performance. Also, for similar cambers, the farther forward the point of maximum camber (A) the thinner the section required; and vice versa. Alternatively, to thicken up a section slightly, with a given amount of camber, move the point of maximum camber back for similar overall efficiency. Basically: very thin sections, keep the point of maximum camber well forward; with thicker sections (e.g., necessitated by required spar depth), move the point of maximum camber farther aft. Within the range of orthodox model sections the maximum aft position for the point of maximum camber is about 35 to 40% chord.

Sections with little or no camber will benefit from being thickened up. A limit to very thin sections for model work is about 5% of the chord; 10% is an average figure for normal (moderately cambered) sections; 12½% for sections with fairly small camber; and 15% for sections with no camber at all (e.g., a "flat plate" centre line). The 10% and 12½% thick sections embrace those aerofoils which produce a flat undersurface, recognised as the general purpose types for model work, the flat undersurface being produced as a deliberate straightening out of the lower symmetrical fairing applied to the aerofoil camber line, or laid out as a definite straight line with an upper surface fairing derived separately.

A flat undersurface aerofoil of less than 10% thickness/chord ratio will tend to lose in efficiency, but more particularly as regards performance in the region of maximum lift. At lower angles of attack they may have a superior performance over more cambered, or thicker aerofoils. Hence thin flat sections may well give improved power-on performance on power and rubber models (where the wing is operating at a fairly low angle of attack), but will almost invariably show an inferior glide performance (with the wing now operating at a higher angle of attack).

The usual compromise is a thin cambered section, with more camber permissible on rubber models than on power duration designs, because stability requirements are not so critical. In practice, however, there is a tendency to contradict the general rule in that rubber model sections may be thicker than the less cambered power duration sections. As a result the typical power model section is probably less efficient than its rubber model counterpart, this being dictated by the necessity of having a relatively high speed (low cambered) section for maximum climb and good climb stability.

Normally the maximum camber in a model aerofoil is restricted to about

6%, anything much higher tending to produce drag values too high to take advantage of any possible increase in lift. Also, increasing camber tends to unstabilise the aerofoil by increasing the centre of pressure travel and make the stall more violent.

Centre of pressure travel can be reduced to the point of being virtually constant over the normal operating range by using a reverse camber over the rear portion of the camber line, producing what is known as a reflex section when the fairing is added—Fig. 4. This benefit is gained only at the expense of loss of lift and an increase in drag. A reflex section is therefore only normally employed on models where a very stable wing is required, e.g., on a tailless model, and never on orthodox duration designs. Where maximum performance is required, it is more common to deform the trailing edge of the section in a contrary manner to add a flap effect. This has a somewhat different effect to merely increasing the camber and is a tried and proven method of increasing lift without adding too much drag, provided only moderate flap angles are used.

The other type of "stable" aerofoil, i.e., with little or no centre of pressure travel, is the one with a straight centre line. The basic flat plate is a stable aerofoil in that the change of centre of pressure with angle of attack tends to return the section to its original position, which condition is reversed immediately the plate is curved or cambered. Symmetrical sections built up of symmetrical fairings added around a straight "camber" line are also stable, but not good lift producers unless they are operated at a fairly generous angle of attack. Even then their performance in this respect cannot compare with that of a cambered section. Thus camber is an essential feature of a good lifting section, but a symmetrical section can also be used for lifting where optimum performance is not required, or the other characteristics of the section can be put to advantage. Outstanding examples here are the symmetrical wings used on models designed to operate in inverted flight (where similar upside down characteristics are required), such as control line stunt models and advanced radio control machines. Even here, however, where the predominant flight attitude may be the right way up, a bi-convex section of generous thickness and slight camber may be expected to give a slightly superior "upright" performance at the expense of some loss of lift when inverted. A symmetrical section is not necessarily the best wing section for a model designed for inverted flying, although it is the obvious one.

With the general characteristics of camber and thickness chord ratios in mind, it is possible to assess the general merits of a particular section merely by plotting it out and studying its form. Certain sections are deformed for structural reasons (e.g., Marquardt and R.A.F. 15) in order to accommodate necessary spars conveniently; others are theoretically derived to the point where they are not thick enough to take the spar sizes considered necessary for a particular wing. Practical aspects should be weighed against potential aerodynamic characteristics in arriving at a final choice.

Some aerofoil series are also self-explanatory as to their geometric layout. N.A.C.A. aerofoils, for example, are mathematically derived with a standard formula for the shape of the symmetrical envelope added around a mean camber line. These related aerofoils are designated by four or five digits.

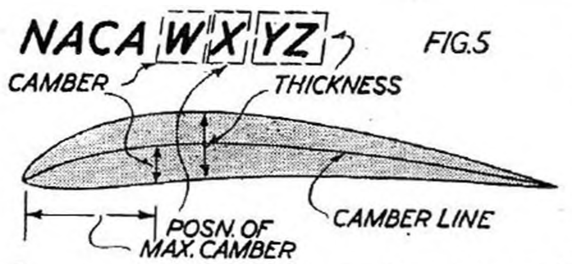


FIG. 5

In the four-digit series, the first digit gives the camber of the centre line (B), the second the position of the point of maximum camber (A), in tenths of a chord; and the last two digits the thickness of the fairing as a percentage of the chord—Fig. 5. Thus N.A.C.A. 6409 s a section with a 6% camber; the point of maximum camber four-tenths of 40% from the leading edge; and 9% total thickness (T/C). In the case of symmetrical N.A.C.A. aerofoils the first two digits become "00", with the last two digits giving the thickness as before, e.g., 0009, a symmetrical section 9% thick; 0012, a symmetrical section 12% thick, etc.

The N.A.C.A. five-digit series follows the same principle, except that the *second and third* digits now designate the position of the point of maximum camber. The first digit gives the amount of camber and the last two the thickness, as before. Coding of the second and third digits is 10, 20, 30, 40, and 50, corresponding to a value of A of 5, 10, 15, 20 and 25% chord, respectively. Thus N.A.C.A. 43012 corresponds to a section with a 4% camber located at **15**% of the chord, and maximum thickness 12%.

Some of the more modern model sections follow a similar system of coding. In other cases the coding of aerofoils is purely arbitrary and although the same family name is used, the respective aerofoils may or may not be part of a definite series. In the case of the R.A.F. aerofoils, for instance, R.A.F. 15 was virtually drawn in around a leading edge and two mainspars, utilising a camber of 2.5%. U.S.A. 27 introduced some years later was obtained by doubling the R.A.F. 15 ordinates. The R.A.F. series 30-33 were developed as a series, R.A.F. 30 being the symmetrical section, R.A.F. 31 and R.A.F. 32 derived from it by adding 2 and 5% camber, respectively to it. R.A.F. 33 was produced by adding a reflex trailing edge to R.A.F. 32. R.A.F. 34 came out much later as a bi-convex section with a cusp-shaped rear portion and a 4.2% camber. The Gottingen aerofoils started out as a series of "teardrop" sections, but the numbers imply only an arbitrary designation. The Munk "M" series (1-12) designate systematic variation of thickness and camber with a single profile shape (the Grant G-9 is identical with the M-9). There is also a variety of individual sections derived by "mixing" the top and bottom ordinates of established sections. In such cases, detailed examination of the actual profile will classify it according to geometric layout.

WHAT'S THE AREA

THE most direct method of laying out a wing or tailplane planform is to ignore tip shapes initially and break the wing up into a series of well defined geometric shapes, each of which then readily lends itself to the calculation of area, etc. There are several ways of going about the job, but in the main the main requirement is a wing or tailplane of given *area*, proportioned to fall within a suitable range of *aspect ratio*. Requirements for *area* for models built to FAI contest specifications, etc., can be determined from Chart I, whence span for a given *aspect ratio* can be determined from Chart II.

The main table following lists basic calculations covering a range of the more unusual planforms. The simplest shape, both for layout and calculation, is of course the purely rectangular form A. Taper wings, e.g. B and C, or compound wings, D and G, require a little more calculation to arrive at the required proportions, but all can be worked out by simple arithmetic. In type C a wing (or tailplane) is shown butting against the sides of a fuselage. For competition specification purposes, the imaginary centre section counts as effective area (the same applying to any other shape of wing arranged in a similar manner). The actual or "real" wing area is known as the nett area; the overall area the gross area.

The elliptic planform shown in E is best laid out by means of ordinates. It is somewhat broader along its span, and therefore slightly greater in area, than a parabolic shape of the same span and root chord. (F)

Span may be calculated direct as a function of the chord and the wing area required, the necessary formulas being given in the second column. This is a quick and easy method of fixing a suitable chord size for a tentative selection of span. The final aspect ratio can be then calculated from the third column of formulae.

The effective specifiation area is the *projected* area of the completed wing—Fig. 1. Dihedral on part or whole of the wing produces a projected area smaller than the area calculated on the layout span, easily found by multiplying the layout area by the area factor given in the table. With dihedral, the rigging span or extreme measure from tip to tip is less than the layout or flat span. When a designer wishes to take full advantage of the rules with a "limited area" specification he can, therefore, increase the layout span on dihedralled sections of a wing (or tailplane), e.g. by multiplying the layout span figure calculated to give the exact layout area required by the span factor given in the table. It will be noticed, however, that any increase in span will be quite small for low dihedral angles and it is more usual practice to play safe and work entirely on the basis of layout areas, except where very large dihedral angles may be involved.

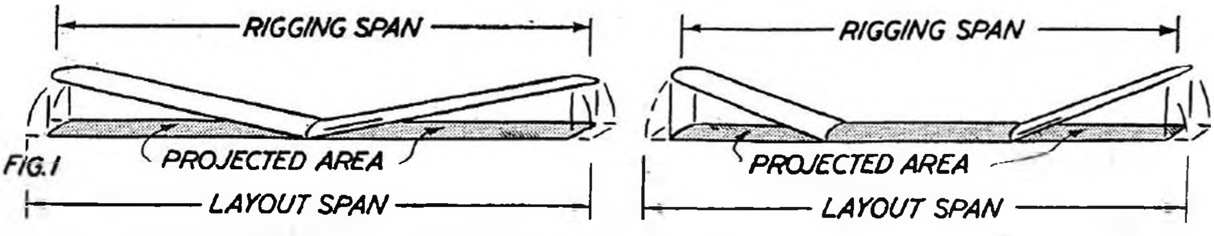
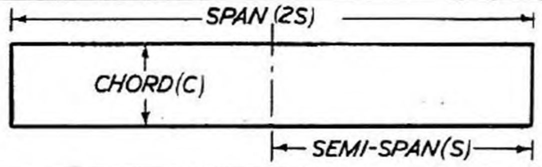
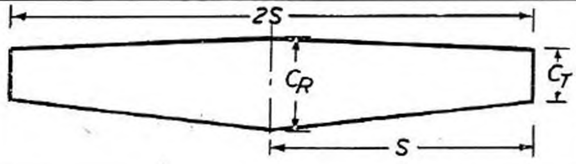
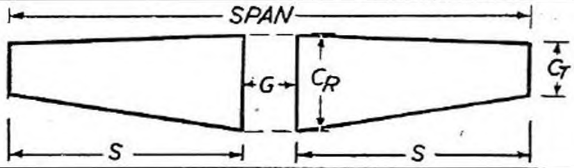
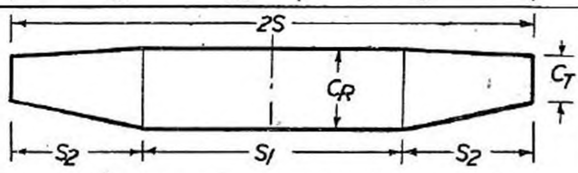
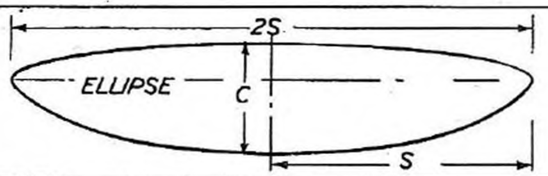
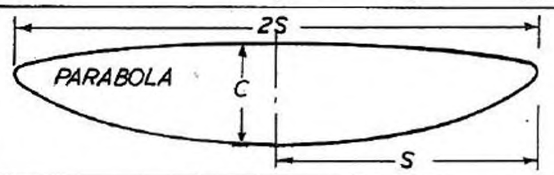
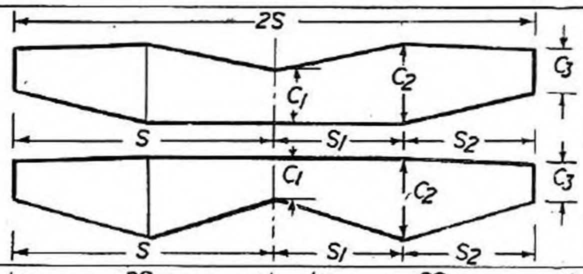
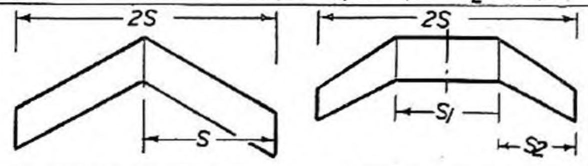
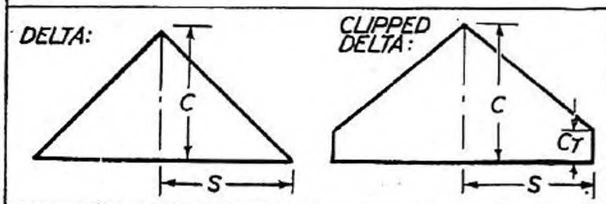


FIG. I

DIHEDRAL-DEG.	5	6	7	8	9	10	12½	15	17½	20	22½	25	30	35
AREA FACTOR	·996	·995	·993	·990	·988	·985	·976	·966	·954	·940	·924	·906	·866	·819
SPAN FACTOR	1·004	1·006	1·008	1·01	1·013	1·015	1·024	1·035	1·049	1·064	1·082	1·103	1·115	1·221

AREA CHART : WINGS AND TAILS

	PLANFORM	AREA	SPAN 2S FOR GIVEN AREA	ASPECT RATIO
A		SPAN x CHORD or 2SC	$\frac{AREA}{C}$	$\frac{2S}{C}$ or $\frac{4S^2}{AREA}$
B		$S(C_R+C_T)$ or FSC_R	$\frac{2 \times AREA}{C_R+C_T}$	$\frac{4S}{C_R+C_T}$
C		nett: $S(C_R+C_T)$ gross: $S(C_R+C_T)+C_RG$	$\frac{2 \times AREA}{C_R+C_T}+G$	$\frac{SPAN^2}{S(C_R+C_T)+C_RG}$
D		$S_1C_R+S_2(C_R+C_T)$ or $C_R(S_1+S_2)+S_2C_T$ or $C_R(S_1+FS_2)$	$\frac{2 \times AREA + S_1C_R(F-2)}{FC_R}$	$\frac{4S^2}{S_1C_R+S(C_R+C_T)}$
E		$1{\cdot}57\,SC$ or $\frac{11SC}{7}$	$\frac{1{\cdot}27 \times AREA}{C}$ or $\frac{14 \times AREA}{11C}$	$\frac{2{\cdot}55\,S}{C}$ or $\frac{28S}{11C}$
F		$\frac{4SC}{3}$	$\frac{1{\cdot}5 \times AREA}{C}$	$\frac{3S}{C}$
G		$S_1(C_1+C_2)+S_2(C_2+C_3)$ or $SC_2+S_1C_1+S_2C_3$ when $C_1=C_3=C_2/2$ AREA $=1{\cdot}55\,C_2$	$\frac{4 \times AREA}{3C_2}$	$\frac{4S^2}{SC_2+S_1C_1+S_2C_3}$
H		SWEPT WINGS CALCULATED FOR APPROPRIATE PLAN – S MEASURED AT RT. ANGLES TO ℄		
J		DELTA: SC CLIPPED DELTA $S(C+C_T)$	$\frac{2 \times AREA}{C}$ $\frac{2 \times AREA}{C+C_T}$	$\frac{4S}{C}$ $\frac{4S}{C+C_T}$

C_T/C_R	·5	·6	·7	¾	·8	·9
F	1·5	1·6	1·7	1·75	1·8	1·9

Tip Shapes

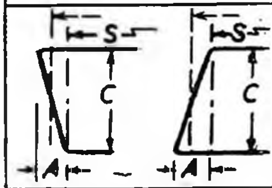
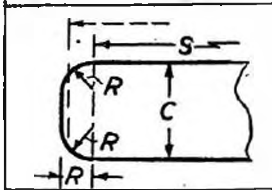
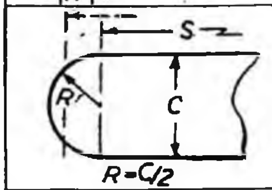
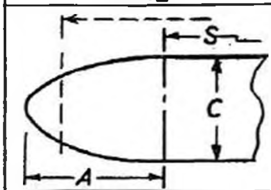
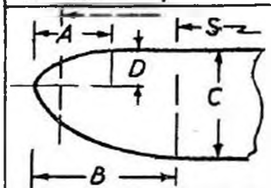
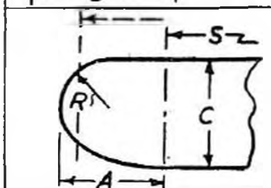
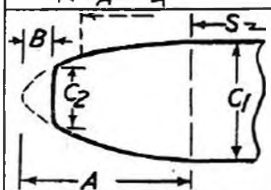
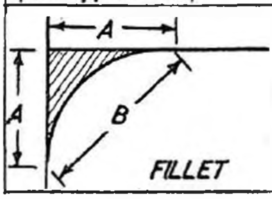
Although squared tips are now commonplace on models, rounded or curved tips are more pleasing in appearance and, on wings at least, are considered aerodynamically superior. Any tip shape other than the natural end forms given in the basic layouts in the area chart naturally modify the area of the final wing.

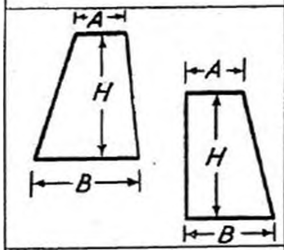
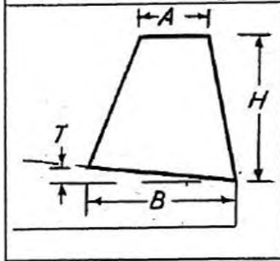
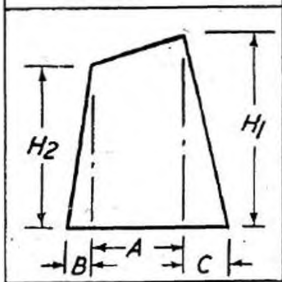
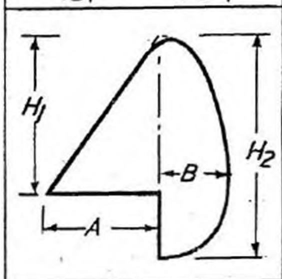
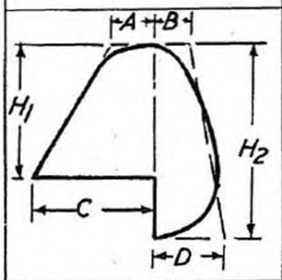
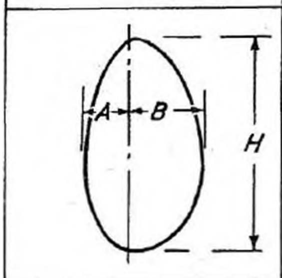
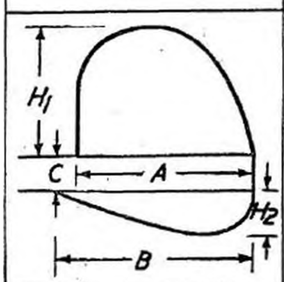
There are two alternative methods of calculating the final areas. The wing can be considered as terminating short at the start of the tip, the tip area calculated separately and added; or an equivalent rectangular area can be computed and the total area calculated as with the basic shapes, but with an increment to the appropriate span dimension.

Raked tips are generally superior, aerodynamically, to straight rectangular tips and have the same structural simplicity. The sharp edges resulting are invariably rounded off, resulting in a small loss of area, but this can be ignored in calculation. The blunt rounded tip has more generous curves and is used both with the same radius at leading and trailing edge or with a smaller radius at the trailing edge. In the latter case the area is less, and the span increment less than that given by the formula.

In the case of compound shapes, employing either true radii, elliptic curves, or similar, areas and span increment will be sufficiently near to the general cases illustrated for most design purposes. In fact, it is seldom practical to attempt area calculation with any more complex tip forms and if the area must be determined exactly in such cases it is usually simpler, and much quicker, to compute such areas by squared paper or weighed templates (see later).

A solution is also given for the area of circular fillets, which have normally to be computed in with wing area under contest rules. The formula based on the diagonal length of the fillet can be used for non-circular fillets.

TIP SHAPE	CALCULATED AREA ADDED TO WING (EACH TIP)	RECTANGULAR EQUIV'S'
	$\frac{AC}{2}$	$S + \frac{A}{2}$
	$R(C - \cdot43R)$	$S + R - \frac{\cdot43R^2}{C}$ or $S + \frac{R(C - \cdot43R)}{C}$
	$\cdot39C^2$ or $\frac{11C^2}{28}$	$S + \cdot39C$
	$\cdot785AC$ or $\frac{11AC}{14}$	$S + \cdot785A$ or $S + \frac{11A}{14}$
	$\cdot785BC + \cdot215BD - \cdot215AD$ or $\cdot215D(B-A) + \cdot785BC$	$S + \frac{TIP\ AREA}{C}$
	$\cdot215R(A-R) + \cdot785AC$	$S + \frac{TIP\ AREA}{C}$
	$\cdot785(AC_1 - BC_2)$	$S + \frac{TIP\ AREA}{C}$
	$\cdot215A^2$ or $\cdot108B^2$	—

FIN SHAPE	AREA
	$\frac{H(A+B)}{2}$
	$\frac{(H-T/2)(A+B)}{2}$
	$\frac{(H_1+H_2)A+BH_2+CH_1}{2}$
	APPROX: $\frac{AH_1}{4}+\cdot 8BH_2$
	APPROX: $\frac{H_1(A+B)+H_2(B+D)}{2}-\frac{D^2}{5}$
	APPROX: $\cdot 785H(A+B)$
	APPROX: top: $\cdot 8AH_1$ bottom: $\frac{BH_2}{2}$ gross: TOP + BOTTOM + AC

Fin Shapes

It is most fortunate that fin area is not as critical as some designers imagine (and no limits on fin area are included in contest specifications) as the variety of shapes employed do not always lend themselves to easy calculation. Quite a number of fins are designed merely by freehand drawing, matching what appears to be the right size with a side elevation of the model. A common tendency, using this method, is to produce an undersize fin—the fin nearly always appearing larger on the drawing than when built and fitted to the model and viewed as part of the complete assembly.

Simple geometric shapes for fins e.g. rectangular with square or rounded tips, ellipses, etc., can be computed according to the formulas given in the main area chart. A majority of other shapes can be analysed as derived from, or fitting around, a quadrilateral form.

The first diagram shows a simple basic shape with parallel top and bottom and the second the effect of a tapered base (or top). Calculation of area is straightforward in either case. Quadrilateral shapes can also be computed on the layout arrangement given in the third diagram.

Fins employing rounded or curved outlines can be computed on close approximate lines, either by breaking them up into matching standard geometric forms or enclosing them within a near-equivalent straight line outline. Both methods are used in dealing with the remainder of the fin shapes illustrated. The bottom shape is typical of blunt-rounded outlines frequently employed on power models. For exact area determination of complex outline shapes, squared paper or weighed templates should be used.

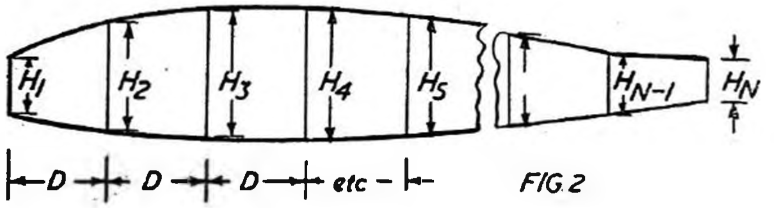


FIG 2

AREA =

$$\frac{D}{3}\left(H_1 + H_N + 2\Sigma H_{odd} + 4\Sigma H_{even}\right)$$

(N even)

or

$$D\left(\frac{H_1 + H_N}{2} + \text{SUM } H_2 \text{ to } H_{N-1}\right)$$

Miscellaneous Areas

The method of finding the area enclosed within an irregular outline by drawing it on squared paper (or imposing a grid over the outline) and counting the number of whole and half or more squares included within the outline is quite accurate—if tedious. For most purposes a grid of ½ inch squares will be adequate, with ¼or .2 inch squares for closer working. The smaller the individual squares the more accurate the final count should be—and the longer work the will take.

A quicker, and extremely accurate, alternative is to take a piece of fairly stout card cut square to some convenient size. Weigh the card and calculate the area (which is simplified by cutting the card to some easy square dimension, e.g. 10 inch sides). The outline of the shape required is then traced onto the card and cut out. Weigh the template so produced. The area of the template shape can then easily be calculated by simple proportion. This method can also be used to find the centre of an area quickly and without calculation, balancing the template on a knife edge in two directions roughly at right angles and marking the point of intersection.

In the case of fuselage side elevations, where the centre of area is more important than the actual area, scale (e.g. half-size) templates can be used, as being more economic in material and more practical for handling. Calculation of actual areas of fuselage shapes, etc., can be carried out using Simpson's rule, the trapezoidal rule, Durands's rule, etc., the former two being illustrated in Fig. 2. The shape is first divided into a number of equal strips (an even number of strips to apply the first of Simpson's rule) and heights at the respective measures. Either of the two formulas can then be used to give the area enclosed within the figure, the second being the simpler to apply but a less accurate approximation. The closer the spacing of the measured heights (i.e. the smaller "D") the greater the accuracy of the result.

A frequent source of confusion in dealing with contest specifications is the conversion of English into metric units, and vice versa. The following abridged tables will enable such conversions to be done quickly and accurately for any area of from one square unit upwards.

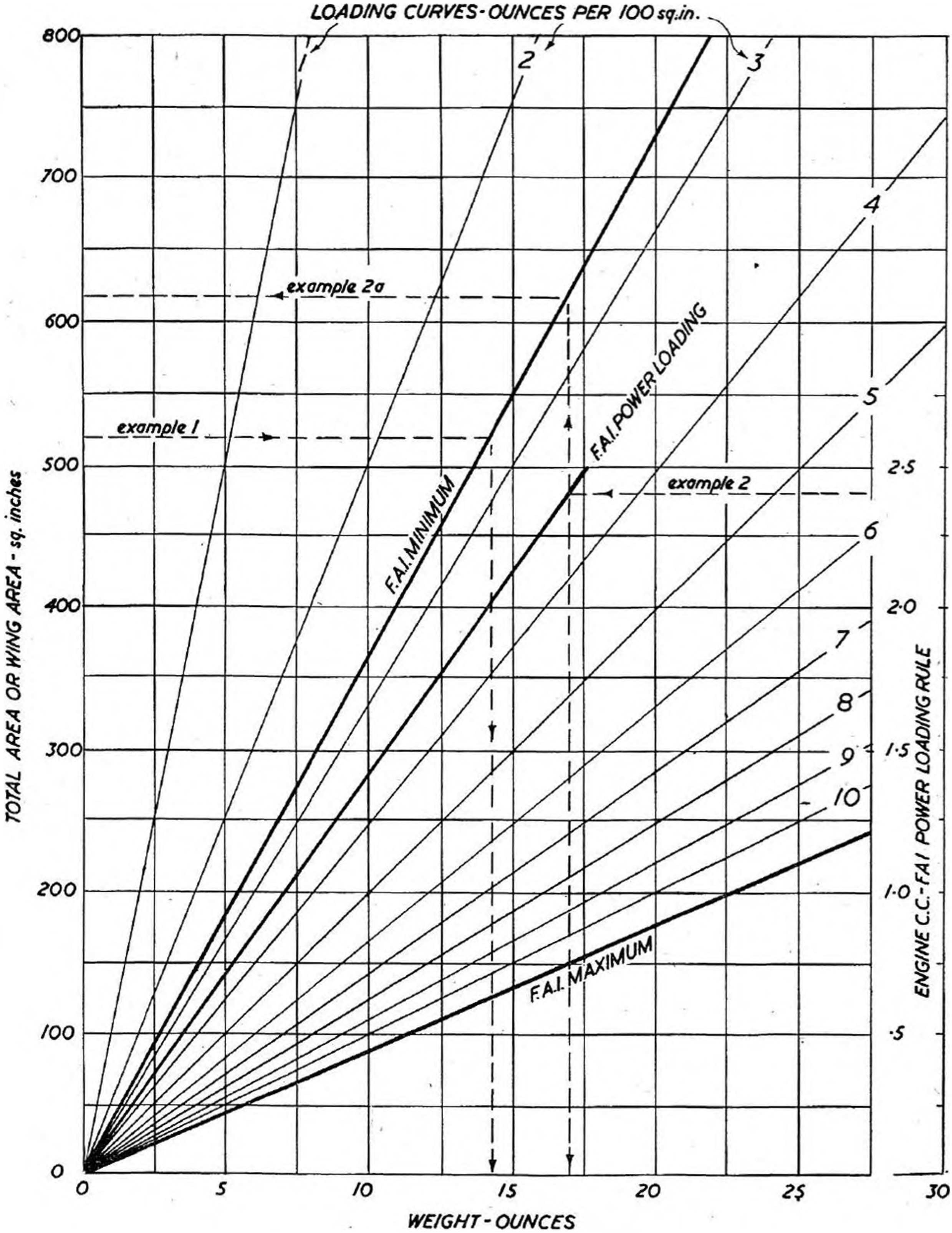
Sq. inches ...	1	2	3	4	5	6	7	8	9	10
Sq. cm. ...	6.452	12.903	19.359	25.806	32.258	38.710	45.161	51.613	58.069	64.516
Sq. cm. ...	1	2	3	4	5	6	7	8	9	10
Sq. inches ...	.155	.310	.465	.620	.775	.930	1.085	1.240	1.395	1.550

Note: to convert tensor hundreds, etc., multiply conversion by 10,100, etc. For mixed numbers, split up into units, tens, hundreds, etc., find conversion equivalents separately and add. E.g., to convert 352 sq. in. to sq. cm.

300 sq. in. = 100 x 3 conversion = 1,935.4 sq. cm.
50 sq. in. = 10 x 5 conversion = 322.58 sq. cm.
2 sq. in. = 2 conversion = 12.903 sq. cm.

Total = 2,270.883 sq. cm.

CHART I LOADING/AREA



Example I: Given that the total area of a model is 520 sq. in., to find the minimum weight required to conform to F.A.I. specification.

Trace across from 520 sq. in. area to cut the "F.A.I. Minimum" diagonal and project down to the bottom scale—Ans. 14.2 ounces.

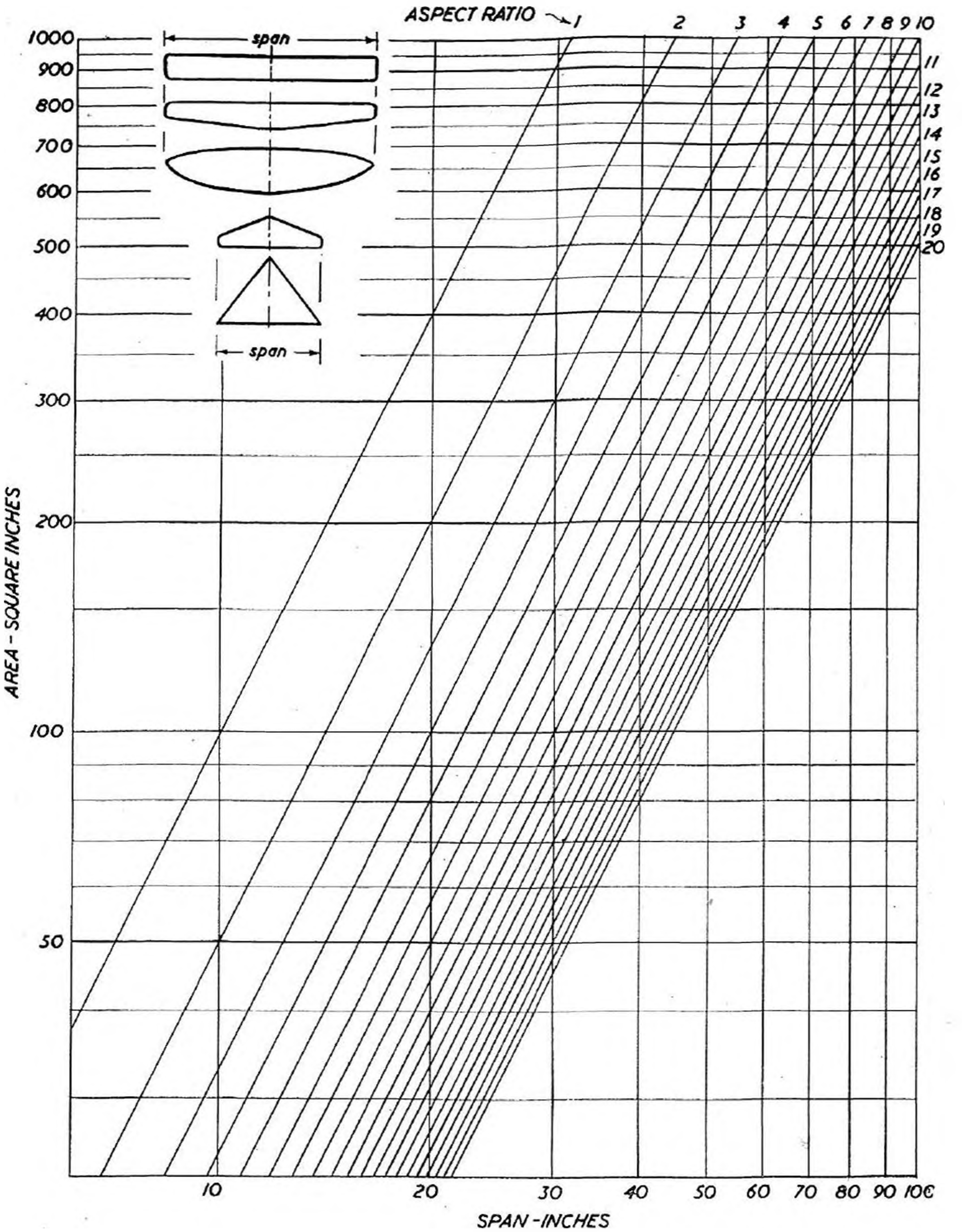
Example II: Using a 2.4 c.c. engine, what is the minimum F.A.I. weight for the model?

Project across from the engine c.c. scale to cut the "F.A.I. Power Loading" diagonal and down to the bottom weight scale.—Ans. 17 oz.

To find the associated area for minimum F.A.I. loading, project upwards and across.—Ans. 620 sq. in. total area. (Example 2a).

The other diagonals are used for computing weight or area for any required loading figure; or arriving at the loading figure knowing weight and area.

CHART II : ASPECT RATIO



This chart can be used to determine area, aspect ratio or span, knowing any two, irrespective of the actual planform of the wing or tailplane involved. For example, the span required to give a certain aspect ratio with a wing of a definite area can be found by projecting across from the area scale to cut the required aspect ratio diagonal and then vertically downwards to give the appropriate span reading.

If necessary, intermediate readings of aspect ratio can be estimated, either as solutions or as part of the process in finding required span or resulting area. Area and span values can be spotted with accuracy, bearing in mind that both are laid out in the form of logarithmic scales (i.e. similar scales to those employed on a slide rule).

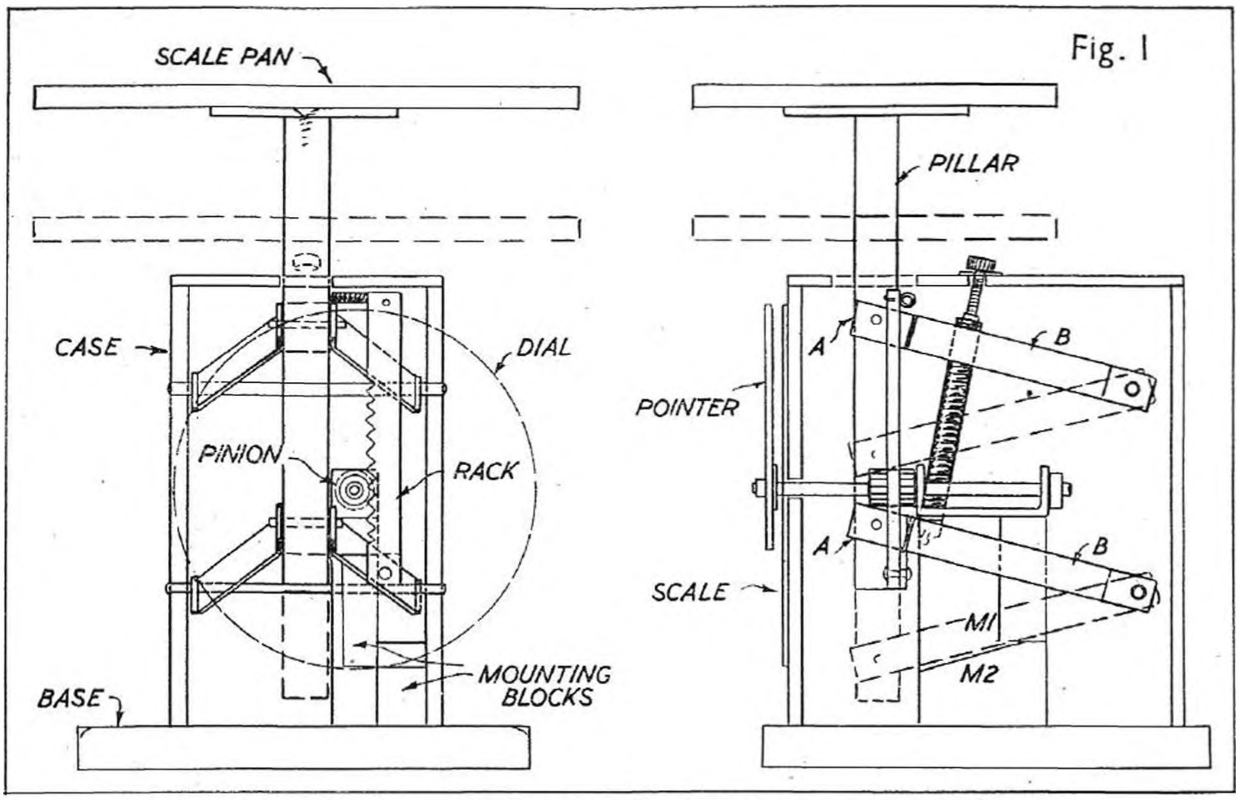


Fig. 1

SPRING BALANCE

WEIGHT control is a vital factor in aircraft construction—model or full size. For model work, a direct-indicating weighing machine is the most convenient to use for average weight. Beam balances are somewhat easier to construct but not so easy to use. They are also more readily damaged, or the vital weights lost.

Direct-indicating balances are usually of the spring or counterweight type, the former requiring less meticulous construction for accurate results with the further advantage that a much larger scale is possible. The "AEROMODELLER" balance has been designed on this principle, combining two typical commercial movements employed in letter balances, etc.

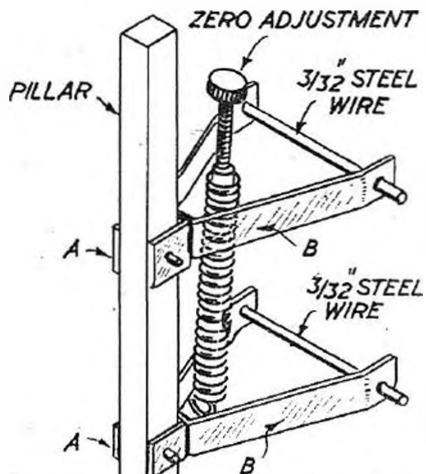
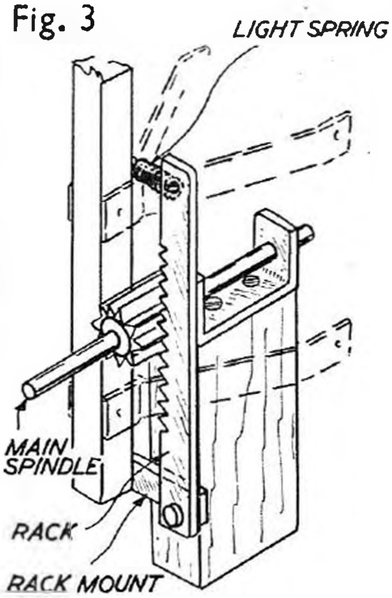


Fig. 2

A general arrangement of the balance is shown in Fig. 1 with the basic movement extracted and drawn separately in Fig. 2. A vertical pillar is suspended from two pivoted brackets and is free to move up and down over a total travel of $1\frac{1}{2}$ inches. This travel is not quite parallel, the horizontal displacement over the full travel being approximately 3/32 inch.

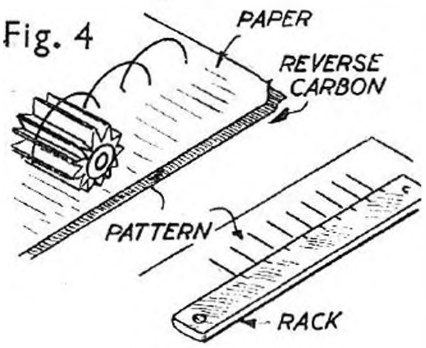
To translate this vertical travel into a pointed movement over a dial the main spindle is fitted with a $\frac{3}{8}$-inch diameter pinion engaging a rack pivoted to the pillar. A light spring holds the rack against the pinion—see Fig. 3. The full travel of the pillar then produces one complete revolution of the spindle, the rack having a slight sliding as well as up and down motion. Opposing any downward motion of the pillar is a coil spring, attached to the bottom bracket and to the top of the case. A zero adjustment screw fitted to the other end of the spring enables the tension in the spring to be adjusted to zero the pointer on the scale before loading the scale pan with an object to be weighed. Neither the dimensions nor the layout shown need be rigidly adhered to as the balance is finally calibrated with check weights and so any variations can be cancelled out at that stage. The same basic movement should be employed, however.

Fig. 3



The pinion should be brass, taken from an old clock or toy mechanism, etc., about $\frac{1}{2}$ inch long and with approximately 12 teeth. Lay a piece of carbon paper, reverse side up, under a plain sheet of paper and roll the pinion along it—Fig. 4. This will mark an impression of the teeth spacing on the back of the paper which can be used to lay out the tooth spacing required on the rack. The rack itself is cut from 16 s.w.g. brass and the teeth formed in it by filing, over a length of $1\frac{1}{2}$ inches. It is not difficult to file a smoothly matching rack in this manner, checking against the pinion as work proceeds.

Fig. 4



Each of the pivoted brackets is made from two pieces, A and B, cut from sheet brass, drilled and bent to shape. Assemble A to B by riveting, screwing (e.g. 8 BA screws) or soldering, as detailed in the main drawing. The pillar is a 5 inch length of $\frac{1}{2}$ inch square straight grained hardwood which is drilled as indicated and fitted with bushings. These bushes are $\frac{1}{2}$ inch lengths of 16 s.w.g. brass tube pushed into slightly undersize holes in the wood. Brackets and pillar can now be assembled, using short lengths of 16 s.w.g. wire—see Fig. 2. Solder the wire to the brackets to prevent them working loose and check that the movement is quite free.

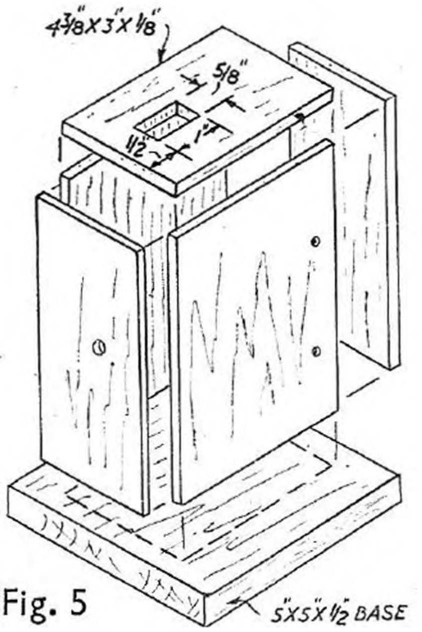


Fig. 5

The small brass plate forming the rack mount is then attached to the bottom of the pillar with woodscrews. Mount the rack, using a rivet or BA screw for the pivot and check that it moves freely with no wobble. The rack should be parallel to the pillar.

The case parts can now be cut (see main drawing and Fig. 5.) and the two sides assembled on the base, using cement. Check that they are true and square. Make and attach the spindle bracket to the larger of the wooden mounting blocks—Fig. 6. Solder the pinion to the spindle, assemble and lock by means of a collar or soldered washer.

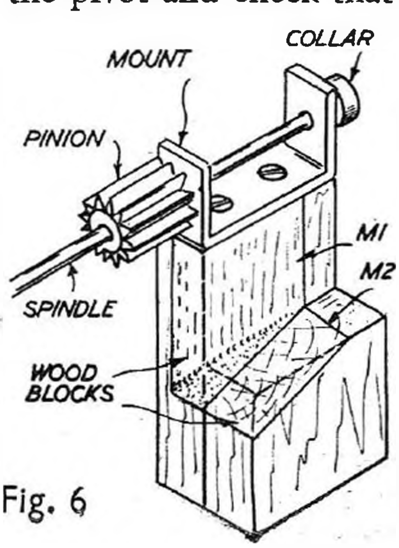


Fig. 6

Temporarily assemble the pivoted system by means of lengths of 3/32 inch diameter steel wire pushed through the sides of the case, position the spindle assembly so that pinion and rack engage smoothly, trimming block M1 as necessary to give free movement and then cement the blocks to the case. Cement in the back of the case to stabilise the whole lot.

It may not be necessary to withdraw the pivoted assembly again, but this can be done if it makes the work easier simply by pushing out the two rear wires. Hook one end of the main spring to the bottom bracket (e.g. through a hole drilled in bracket B on the opposite side to the rack), lay the top of the case in place and mark a suitable position for drilling a hole for the zero adjusting screw to emerge. Drill this. Fit the collar into the spring, engage the adjusting screw through the lid and replace the lid.

At this stage the balance should be fully working, although there is still no pointer attached. The size of spring shown, wound from 20 s.w.g. wire, should give a balance reading 0-16 ounces for a full scale deflection (one revolution). A lighter spring will give a lower scale range, and vice versa. The spring can be wound around a suitable mandrel, or purchased. It is suggested that in such cases a range of three or four springs of the approximate specification be bought and checked and the one best suited finally selected.

To carry out such checks, fit the brass or ply scale pan support temporarily. In the case of a 0-16 ounce balance, a pound package of butter can be used as a check weight. Lay in place and check that the main spindle rotates approximately one complete turn under this weight. Try different springs until this is so. Your maximum weight check weight should give between $\frac{3}{4}$ and 1 complete revolution of the main spindle.

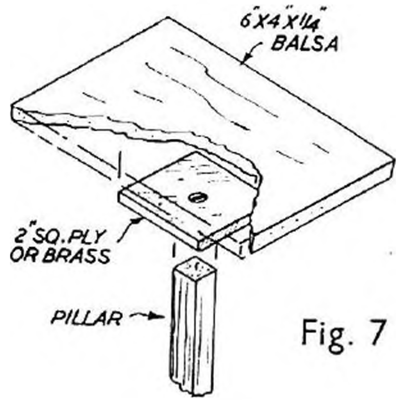


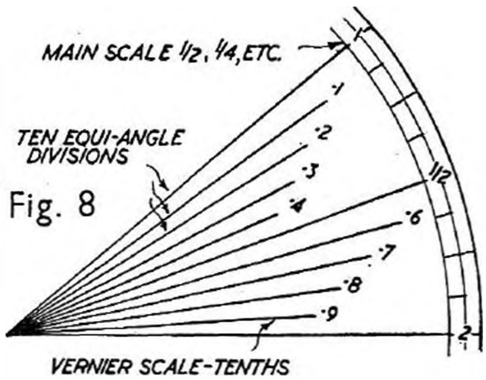
Fig. 7

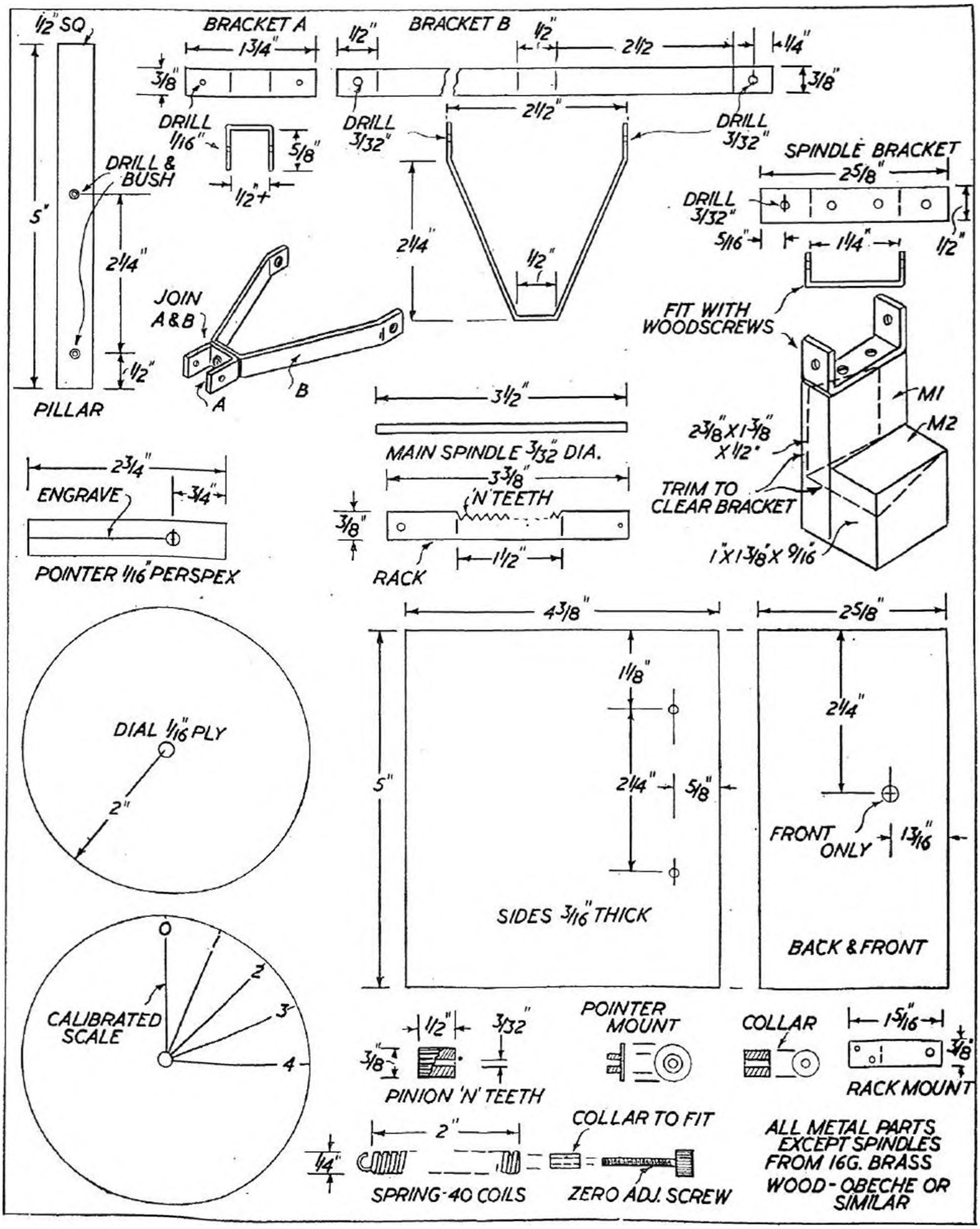
When you have established the correct spring size in this manner, cement the top in place and fit the front of the case. The dial is cut from 1/16 inch ply and cemented in place and the scale pan proper fitted—Fig. 7. The pointer can be a length of 20 s.w.g. wire with one end wound into a short coil which is a tight push fit on the spindle; or from 1/16 inch "Perspex" fitted to a suitable metal boss or bushing. The latter should be scribed with a hairline scratch, touched in with black dope and is preferable when using a fully calibrated scale.

Before attempting to calibrate the scale, the working of the balance should be checked. The scale should be linear, i.e. equal increments for equal added weights and this should be checked with suitable weights. Failing standard weights, coins can be used, five halfpennies or three pennies weighing almost exactly one ounce. Most probably at this stage the scale will not be quite linear, due to the fact that the initial tension of the spring has not been taken up. It may be necessary to add ballast to the moving system (e.g. solder, etc., wrapped round the top of the pillar), readjusting (increasing) spring tension to zero the pointer each time. It is worthwhile carrying out such adjustment since the full scale can then be plotted with the aid of a single accurate check weight.

A standard method of marking out a weight scale is to progressively halve the main divisions, so that the final scale is marked out in $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$ ounce units. This should be done around the perimeter of the scale—Fig. 8. If the angle between each unit division, i..e between full ounces, is measured, this should be divided by ten and radial lines drawn at each one-tenth division, as shown. With staggered numbering and a hairline pointer, very accurate interpretation of the scale reading is possible.

The basic procedure in marking out the scale is to establish one or two definite points with known, accurate weights and work out the common difference per ounce.





List of British National Model Aircraft Records

31st August, 1955

Rubber Driven

Monoplane ...	... Boxall, F. H.	(Brighton)	15/ 5/1949	35 : 00
Biplane ...	... Young, J. O.	(Harrow)	9/ 6/1940	31 : 05
Wakefield ...	... Boxall, F. H.	(Brighton)	15/ 5/1949	35 : 00
Canard ...	... Harrison, G. H.	(Hull Pegasus)	23/ 3/1952	6 : 12
Scale	... Marcus, N. G.	(Croydon)	18/ 8/1946	5 : 22
Tailless... ...	... Woolis, G. A. T.	(Bristol & West)	10/ 5/1953	3 : 03
Helicopter ...	... Tangney, J. F.	(Croydon & U.S.A.)	2/ 7/1950	2 : 44
Rotorplane ...	... Crow, S. R.	(Blackheath)	23/ 3/1936	: 40
Floatplane ...	... Parham, R. T.	(Worcester)	27/ 7/1947	8 : 55
Flying Boat ...	... Parker, R. A.	(Kentish Nomads)	24/ 8/1952	1 : 05
Ornithopter ...	... White, J. S.	(Barking)	20/ 6/1954	1 : 55

Sailplane

Tow Launch ...	... Allsop, J.	(St. Albans)	11/ 4/1954	90 : 30
Hand Launch ...	... Campbell-Kelly, G.	(Sutton Coldfield)	29/ 7/1951	24 : 30
Tailless (T.L.)...	... Lucas, A. R.	(Port Talbot)	21/ 8/1950	22 : 34
Tailless (H.L.)	... Wilde, H. F.	(Chester)	4/ 9/1949	3 : 17
A/2 (T.L.) ...	... Allsop, J.	(St. Albans)	11/ 4/1954	90 : 30
A/2 (H.L.) ...	... Campbell-Kelly, G.	(Sutton Coldfield)	19/ 7/1951	24 : 30

Power Driven

Class A... ...	... Springham, H. E.	(Saffron Walden)	12/ 6/1949	25 : 01
Class B... ...	... Dallaway, W. E.	(Birmingham)	17/ 4/1949	20 : 28
Class C... ...	... Gaster, M.	(C/Member)	15/ 7/1951	10 : 44
Tailless... ...	... Fisher, O. F. W.	(I.R.C.M.S.)	21/ 3/1954	4 : 12
Scale	... Tinker, W. T.	(Ewell)	1/ 1/1950	1 : 37
Floatplane ...	... Lucas, I. C.	(Brighton)	11/10/1953	4 : 58
Flying Boat ...	... Gregory, N.	(Harrow)	18/10/1947	2 : 09
Radio Control ...	... O'Heffernan, H. L.	(Salcombe)	7/10/1954	151 : 20
				m.p.h.
Class I Speed ...	... Wright, P.	(St. Albans)	7/ 6/1954	111.28
Class II Speed	... Powell, D. R.	(East London)	7/ 6/1954	132.7
Class III Speed	... Davenport, R. F.	(East London)	11/ 7/1954	152.17
Class IV Jet ...	... Stovold, R. V.	(Guildford)	25/ 9/1949	133.3

INDOOR

Stick (H.L.) ...	... Read, P.	(Birmingham)	10/10/1954	23 : 58
Stick (R.O.G.)...	... Monks, R.	(Birmingham)	12/ 9/1954	20 : 30
Fuselage (H.L.)	... Parham, R. T.	(Worcester)	12/ 9/1954	13 : 16
Fuselage (R.O.G.)	... Parham, R. T.	(Worcester)	12/ 9/1954	12 : 10
Tailless (H.L.)	... Monks, R.	(Birmingham)	12/ 9/1954	4 : 13
Tailless (R.O.G.)	... Parham, R. T.	(Worcester)	18/ 8/1951	2 : 28
Ornithopter (H.L.)	... Parham, R. T.	(Worcester)	9/ 1/1954	1 : 10
Helicopter (R.O.G.)	... Parham, R. T.	(Worcester)	23/ 1/1954	4 : 28
Rotorplane ...	... Poole, D.	(Birmingham)	8/ 5/1955	1 : 26
R.T.P. Class A	... Muxlow, E. C.	(Sheffield)	10/12/1948	6 : 05
R.T.P. Class B	... Parham, R. T.	(Worcester)	20/ 3/1948	4 : 26
R.T.P. Speed	... Jolley, T. A.	(Warrington)	19/ 2/1950	42.83 m.p.h.

OUTDOOR (Lightweight)

Rubber Driven

Monoplane ...	... Wiggins, E. E.	(Leamington)	11/ 7/1954	40 : 13
Biplane ...	... O'Donnell, J.	(Whitefield)	18/ 5/1952	6 : 46
Canard ...	... Lake, R. T.	(Surbiton)	7/ 4/1954	7 : 32
Scale	... Woolls, G. A. T.	(Bristol & West)	26/ 6/1955	1 : 22
Floatplane ...	... Taylor, P. T.	(Thames Valley)	24/ 8/1952	5 : 15
Flying Boat ...	... Rainer, M.	(North Kent)	28/ 6/1947	1 : 09

Sailplane

Tow Launch ...	... Green, D.	(Oakington)	11/ 4/1954	36 : 02
Hand Launch ...	... Redfern, S.	(Chester)	11/ 7/1954	11 : 15
Tailless (T.L.)...	... Couling, N. F.	(Sevenoaks)	3/ 6/1951	22 : 22
Tailless (H.L.)	... Wilde, H. F.	(Chester)	11/ 7/1954	9 : 51
Canard (T.L.)	... Caple, G.	(R.A.F. M.A.A.)	7/ 9/1952	22 : 11

Power Driven

Class A... ...	... Archer, W.	(Cheadle)	2/ 7/1950	31 : 05
Class C... ...	... Ward, R. A.	(Croydon)	25/ 6/1950	5 : 33
Tailless... ...	... Fisher, O. F. W.	(I.R.C.M.S.)	27/ 7/1954	3 : 02
Seaplane ...	... Mussell, A.	(Brighton)	11/10/1953	2 : 53

WORLD AND INTERNATIONAL RECORDS

As at 31st August, 1955

No.					
		ABSOLUTE WORLD RECORDS			
	Duration	Koulakovsky, I.	U.S.S.R.	6/ 8/1952	6 hr. 1 min.
	Distance	Boricevitch, E.	U.S.S.R.	14/ 8/1952	378.756 km.
	Height	Lioubouchkine, G.	U.S.S.R.	13/ 8/1947	4,152 m.
	Speed	Vassiltchenko, M.	U.S.S.R.	9/ 1/1953	264.700 km/h.
		Class A.F-1 RUBBER DRIVEN			
1	*Duration*	Kraly, M.	Hungary	20/ 8/1951	1hr. 27min. 17sec.
2	*Distance*	Benedek, G.	Hungary	20/ 8/1947	50.260 km.
3	*Height*	Poich, R.	Hungary	31/ 8/1948	1,442 m.
4	*Speed*	Davidov, V.	U.S.S.R.	11/ 7/1940	107.080 km/h.
		Class B.F-1 POWER DRIVEN			
5	*Duration*	Koulakovsky, I.	U.S.S.R.	6/ 8/1952	6 hr. 1 min.
6	*Distance*	Boricevitch, E.	U.S.S.R.	14/ 8/1952	378.756 km.
7	*Height*	Lioubouchkine, G.	U.S.S.R.	13/ 8/1947	4,152 m.
8	*Speed*	Stiles, E.	U.S.A.	20/ 7/1949	129.768 km/h.
		Class A.F-2 HELICOPTERS—RUBBER DRIVEN			
9	*Duration*	Evergary, G.	Hungary	13/ 6/1950	7 min. 43 sec.
10	*Distance*	Roser, N.	Hungary	9/ 4/1950	238 m.
11	*Height*	*No record established*			
12	*Speed*	*No record established*			
		Class B.F-2 HELICOPTERS—POWER DRIVEN			
13	*Duration*	*No record established*			
14	*Distance*	*No record established*			
15	*Height*	*No record established*			
16	*Speed*	*No record established*			
		Class A.F-3 GLIDERS			
17	*Duration*	Ainadinov, S.	U.S.S.R.	6/ 7/1950	3 hr. 18 min.
18	*Distance*	Szomolanyi, F.	Hungary	23/ 7/1951	139.8 km.
19	*Height*	Benedek, G.	Hungary	23/ 5/1948	2,364 m.
		Class B.F-1 RADIO CONTROL—POWERED			
20	*Duration*	Bethwaite, F.	New Zealand	10/ 1/1955	3 hr. 2min. 6sec.
21	*Distance*	*No record established*			
22	*Height*	Velitchkovsky, P.	U.S.S.R.	3/ 8/1952	845 m.
23	*Speed*	Stegmaier, K. H.	Germany	21/ 3/1954	58 km/h.
		Class F-3 RADIO CONTROLLED GLIDERS			
24	*Duration*	Bethwaite, F.	New Zealand	16/ 5/1954	2 hr.
22	*Distance*	*No record established*			
26	*Height*	*No record established*			
		CONTROL LINE SPEED			
27	*Category I* 0-2.5 c.c. ...	Prati, A.	Italy	6/ 6/1954	190.470 km/h.
28	*Category II* 2.5-5 c.c.	Wisniewski, W.	U.S.A.	5/ 9/1954	230 km/h.
29	*Category III* 5-10 c.c.	Sugden, R.	U.S.A.	24/ 8/1953	248.8 km/h.
30	*Category Jet*	Vassiltchenko, M.	U.S.S.R.	6/ 1/1953	264.7 km/h.

The Federation Aeronautique Internationale now recognises four absolute World Records, plus thirty International Records in sub-classes and categories of flight. Each record to be submitted for certification must be the subject of a file giving all information about the conduct and control of the performance, to enable the certifying authority to judge whether all the required conditions have been satisfied.

The information required in all cases is as follows:

(*a*) Application for certification, giving full details of performance and characteristics of model.
(*b*) Plan, front elevation and side elevation of the model to scale of at least 1/10th.
(*c*) Photograph of model (size 9 cm. x 12 cm.).
(*d*) Additional information according to kind of record claimed:—

- Certificate of timing (for duration and speed records).
- Certificate of take-off and landing (distance records).
- Certificate of measurement of distance (distance records).
- Certificate of test of barograph and height calculations (height record).
- Certificate of length of radius of control line (C/L speed records).
- Certificate of measurement of course (speed in straight line).
- Certificate of measurement of launching cable (glider records).
- Certificate of flotation test (waterplane records).
- Description of any automatic timing apparatus used.

(Specimen forms are contained in the F.A.I. Code Sportif, Section 4, published 1954.)

In free-flight duration attempts, each new record must beat the preceding record by at least 2%, and the loss of height between point of departure and point of landing must not be greater than 9 metres during each minute of flight.

In speed (straight line) attempts, the record is measured over a course of 50 metres for models with rubber motors, and of 100 metres for power driven models. The course must be flown in both directions within 30 minutes. Here, each new record must beat the preceding record by at least 5 km/h.

With distance and height records, the differences between two consecutive records must be not less than 10% and 5% respectively.

Radio controlled records for duration, height, or speed in a straight line require the model to be landed within 500 metres of the take-off point. In distance records the competitor must give in writing the proposed destination point, and at the completion of flight, the model must have landed within a radius of one kilometre of the nominated destination.

Full information on all Records matters should be obtained from the Nationa lAero Club of the country, and the conect application forms as specified by the F.A I. used.

NATIONAL MODEL AIRCRAFT GOVERNING BODIES

In most instances the full-size national aero club is directly responsible for the conduct of model aeronautics, but in some cases, as for example the S.M.A.E., a specialist group has been delegated to handle affairs on behalf of the parent body. To avoid delays in correspondence any letters dealing with model aeronautics should always be very clearly marked as such.

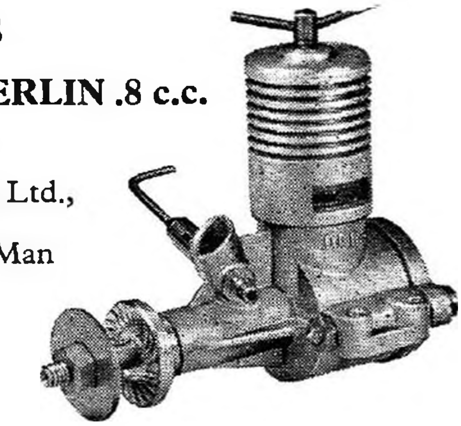
GREAT BRITAIN	The Society of Model Aeronautical Engineers, Londonderry House, Park Lane, London, W.1.
AUSTRALIA	The Model Aeronautical Association of Australia, Sec.: Robert A. Rose, 195 Elizabeth Street, Sydney, New South Wales.
AUSTRIA	Osterreichischer Aero Club, Vienna 1, Dominikanerbastei 24.
ARGENTINE	Aero Club Argentino (Section Aeromodelismo), Rodriguez Pena 240, Buenos Aires.
BELGIUM	Federation de la Petite Aviation Belge, 24 Av. de Haveskercke Forest-Bruxelles.
BRAZIL	Aero-Clube de Brasil, 31, Rua Alvaro Alvim, Rio de Janiero.
CANADA	Model Aeronautics Association of Canada, 1555, Church Street, Windsor, Ontario.
CHILE	Club Aero de Chile, Santa Lucia 256, Santiago.
CUBA	Club de Aviacion de Cuba, Edificio Larrea, Havana
CZECHOSLOVAKIA	Aeroklub Republiky Ceskoslovensko, Smecky 22, Prague 11.
DENMARK	Det Kongelige Aeronautiske Selskab, Norre Farrimagsgade 3 K, Copenhagen.
EGYPT	Royal Aero-Club d'Egypte, 26 Rue Sherif Pacha, Cairo.
FINLAND	Suomen Ilmailuliitto, Mannerheimintie 16, Helsinki.
FRANCE	Federation Nationale Aeronautique (Modeles Reduits), 7, Avenue Raymond Poincare, Paris XVI.
	Aero-Club de France (Modeles Reduits), 6, Rue Galilee, Paris.
	(Communications should always be addressed in duplicate to both these bodies as they jointly share responsibility for certain aspects of aeromodelling.)
GERMANY	Deutscher Aeroclub, e.v. Kommissions-sekretar der MFK, (16) Frankfurt am Main, Taunusanlage 20, Germany.
HOLLAND	Koninklijke Nederlandsche Vereeniging voor Luchvaart, Anna Paulownaplein 3, The Hague.
HUNGARY	Magyar Repulo Szovetseg, V. Sztalin-ter 14, Budapest.
ICELAND	Flugmalafelag Islands, P.O. Box 234, Reykjavik.
INDIA	All India Aeromodellers Association, 8 Lee Road, Calcutta, 20.
IRELAND	Model Aeronautics Council of Ireland, 9, Lower Abbey Street, Dublin.
ISRAEL	Aero Club of Israel, 9 Montefiore Street, P.O.B. 1311, Tel Aviv.
ITALY	Federazione Aeromodellistica Nationale Italiana (F.A.N.I.), Via Cesare Beccaria 35, Rome.
JAPAN	Nippon Koku Kyokai, Kikokan (Aviation) Building 1-3 Tamura-Cho, Minato-Ku, Tokyo.
JUGOSLAVIA	Aero-Club Jugoslavije, Uzon, Mirkova IV/I, Belgrade.
LUXEMBOURG	Aero-Club du Grande-Duche de Luxembourg, 5 Avenue Monteray, Luxembourg.
MONACO	Monaco Air-Club, 8 Rue Grimaldi, Monaco.
NEW ZEALAND	New Zealand Model Aeronautical Association, c/o Mr. A. R. Rowe, 29 Compton Crescent, Taita, Lower Hu't, N.Z.
NORWAY	Norske Aero Club, Ovre Vollgae 7, Oslo.
PERU	Aero Club del Peru, Lima.
POLAND	Aeroklub Rzeczypospolitej Polskie, Ul. Hoza 39, Warsaw.
PORTUGAL	Aero Club de Portugal, Avenida da Liberdade 226, Lisbon.
RUMANIA	Aeroclubul Republico al Romaniei, Lascar Catargi 54, Bucharest.
SOUTH AFRICA	South African Model Aeronautic Association, P.O. Box 2312, Johannesburg.
SPAIN	Real Aero-Club de Espana (Subeseccion de Aeromodismo), Carrera de Jan Jeronimo 19, Madrid.
SWEDEN	Kungl. Svenska Aeroklubben, Malmskillnadsgatan 27, Stockholm.
SWITZERLAND	Aero Club de Suisse (Modeles Reduits), Hirschengraben 22, Zurich.
SYRIA AND LEBANON	Aero Club de Syrie et du Libon, Beyrouth.
TURKEY	Turk Hava Kurumu (T.H.K.), Enstitu Caddesi, 1, Ankara.
UNITED STATES OF AMERICA	Academy of Model Aeronautics, 1025 Connecticut Avenue, Washington 6, D.C.
U.S.S.R.	Aero Club Central de l'U.S.S.R., V. P. Tchkalov, Moscou-Touchino.
URUGUAY	Aero-Club uguay, Paysandu 896, Montevideo.

ENGINE ANALYSIS

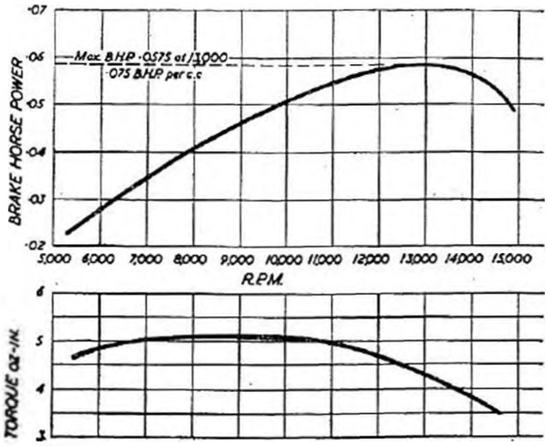
ALLBON MERLIN .8 c.c.

Manufacturers:

Davies Charlton, Ltd.,
Hills Meadows,
Douglas Isle of Man



Retail price 47/6 (including tax)
Displacement: .76 c.c. (.046 cu. in.)
Bore: .375 in.
Stroke: .420 in.
Bore/stroke ratio: 0.9
Max B.H.P.: .0575 at 13,000 r.p.m.
Power rating: .75 B.H.P. per c.c.
Bare weight: 1¾ oz.
Mounting: Beam (8 B.A. screws) or radial
(6 B.A. screws)



Material Specification:
Crankcase: L.A.C. 113A
Crankcase bearing: Plain
Cylinder: S.90
Cylinder jacket: Dural
Piston: Meehanite
Contra-piston: Meehanite
Crankshaft: S.90
Con rod: R.R.56

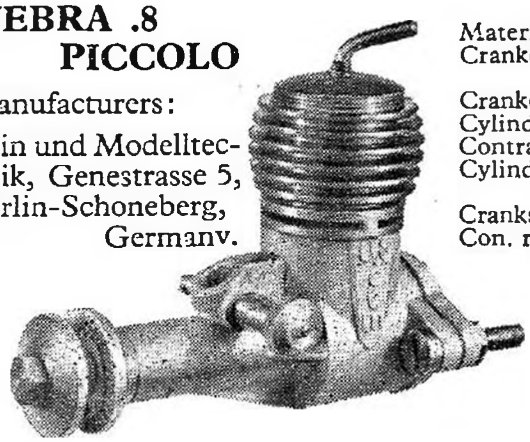
PROPELLER	R.P.M.
dia. pitch	
8 × 4 (Super Seru)	7,000
7 × 6 (Stant)	6,000
7 × 4 (Stant)	8,200
6 × 6 (Stant)	9,500
6 × 4 (Stant)	12,000
6 × 4 (plastic E-D)	12,200
6 × 3	12,400
5 × 3	13,600

Fuel: Allbon diesel fuel (ready mixed)

WEBRA .8 PICCOLO

Manufacturers:

Fein und Modelltechnik, Genestrasse 5,
Berlin-Schoneberg,
Germany.



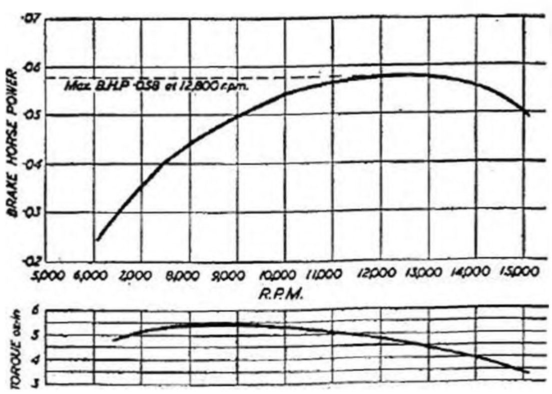
Material Specification:
Crankcase: Light Alloy pressure die casting
Crankcase bearing: Plain
Cylinder: Steel
Contra-piston: Steel
Cylinder jacket: Aluminium alloy
Crankshaft: Hardened steel
Con. rod: Dural

PROPELLER	R.P.M.
dia. pitch	
8 × 4 (Stant)	7,200
7 × 4 (Stant)	8,700
6 × 4 (Stant)	11,250
6 × 6 (Stant)	9,300
6 × 4 (E-D plastic)	12,250
5 × 5 (CGP)	11,800

Fuel: used Allbon diesel fuel

Retail price in U.K. £2 15s. (for export only)

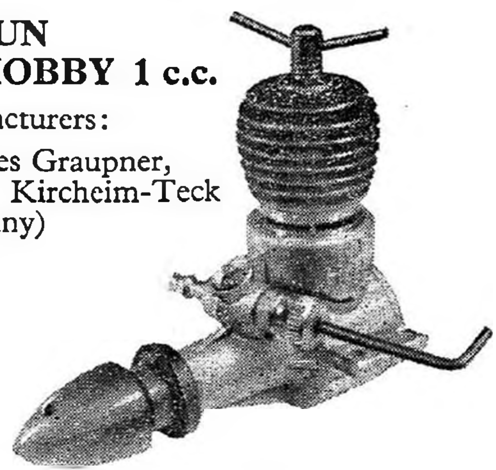
Displacement: .78 c.c. (.047 cu. in.)
Bore: 10.5 mm. (.415 in.)
Stroke: 9 mm. (.354 in.)
Bore/stroke ration: 1.17
Max. B.H.P.: .058 at 12,800 r.p.m.
Power rating: .075 B.H.P. per c.c.
Bare weight: 2⅜ oz.
Power/weight ratio: .024 B.H.P. per oz.



TAIFUN HOBBY 1 c.c.

Manufacturers:

Johannes Graupner,
Kircheim-Teck
(Germany)

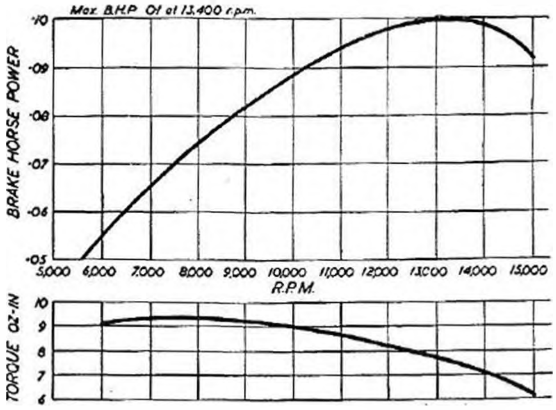


Displacement: 0.98 c.c. (0.06 cu. in.)
Bore: 0.42 in.
Stroke: 0.43 in.
Bore/stroke ratio: 1.0
Bare weight: 2¼ oz.
Max. B.H.P.: .10 at 13,400
Power rating: .1 B.H.P. per c.c.
Power/weight ratio: .047 B.H.P. per oz.

Material Specification:
Crankcase: Die-cast light Alloy
Cylinder: Nickel-chrome steel
Piston: Cast iron
Contra-piston: Nickel-chrome steel
Con. rod: Dural
Crankshaft: Alloy steel
Crankshaft bearing: Plain

PROPELLER dia. pitch	R.P.M.
8 × 4 (Stant)	8,450
6 × 4 (Trucut)	10,700
6 × 3 (Stant)	14,000
15 × 10 cm.	13,150
7 × 6 (Stant)	9,400
7 × 6 (Stant)	12,600
17 × 10 cm.	12,350

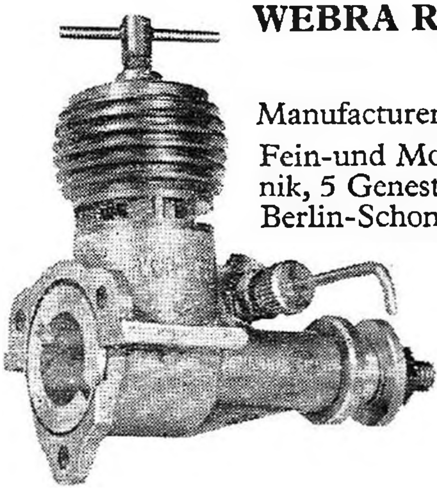
Fuel: Mercury No. 8



WEBRA RECORD 1.48 c.c.

Manufacturers:

Fein-und Modelltechnik, 5 Genestrasse Berlin-Schoneberg, Germany.



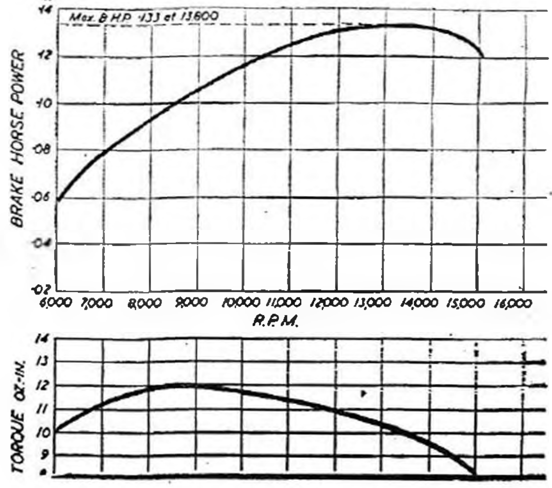
Retail price in U.K. for export only 65/-

Displacement: 1.48 c.c. (.09 cu.in.)
Bore: .51 in.
Stroke: .45 in.
Bore/stroke ratio: 1.13
Bare weight: 3 oz.
Max B.H P.: .133 at 13,800
Max. torque: 12 oz.-in. at 8,600
Power rating: .09 B.H.P. per c.c.
Power/weight ratio: .044 B.H.P. per oz.

Material Specification:
Crankcase: Pressure die-cast light alloy
Cylinder: Steel
Cylinder jacket: Dural (anodised red)
Contra-piston: Steel
Connecting rod: Dural
Crankshaft: Steel
Crankshaft bearing: Plain

PROPELLER dia. pitch	R.P.M.
6 × 6 (Stant)	13,000
7 × 6 (Stant)	11,400
7 × 6 (K-K)	10,200
8 × 4 (Stant)	10,000
8 × 6 (Trucut)	8,600
9 × 4 (K-K)	7,900

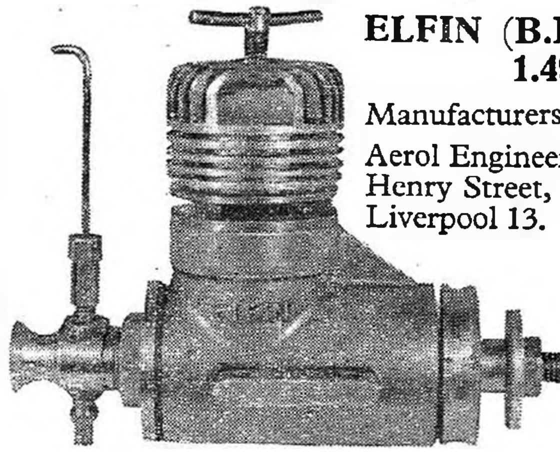
Fuel: R.M. diesel



ELFIN (B.B.) 1.49 c.c.

Manufacturers:

Aerol Engineering, Henry Street, Liverpool 13.

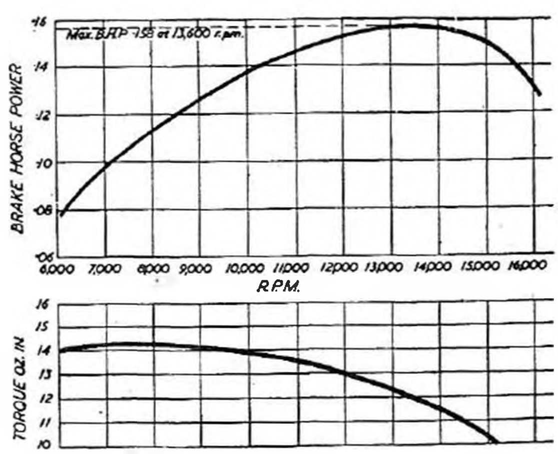


Retail price 91/- (including tax)

Displacement: 1.49 c.c. (.091 cu. in.)
Bore: 0.503
Stroke: 0.460
Bore/stroke ratio: 1.075
Bare weight: 4 oz.
Max. B.H.P.: .158 at 13,600 r.p.m.
Max. torque: 14.3 oz.-in. at 7,500 r.p.m.
Power rating: .105 B.H.P. per c.c.
Power/weight ratio: .04 B.P.H. per oz.

PROPELLER dia. pitch	R.P.M.
8 × 6 (Stant)	8,000
7 × 6 (Stant)	11,800
6 × 4 (Stant)	13,700
6 × 9 (Stant)	15,200
8 × 4 (Stant)	11,000
8 × 6 (K-K)	9,300
7 × 6 (K-K)	10,750
8 × 6 (Trucut)	8,250

Fuel: Allbon diesel fuel

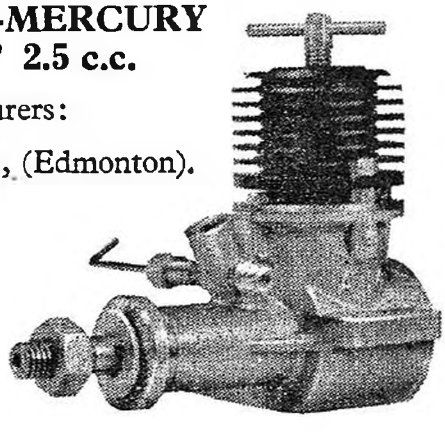


Material Specification:
Crankcase: Pressure die-cast
Cylinder: Nickel steel
Cylinder jacket: Dural
Piston: Cast iron
Contra-piston: Cast iron
Connecting rod: Dural
Crankshaft: Nickel steel
Crankshaft bearings: Two Hoffman ball races

ALLEN-MERCURY "25" 2.5 c.c.

Manufacturers:

Allen Eng., (Edmonton).



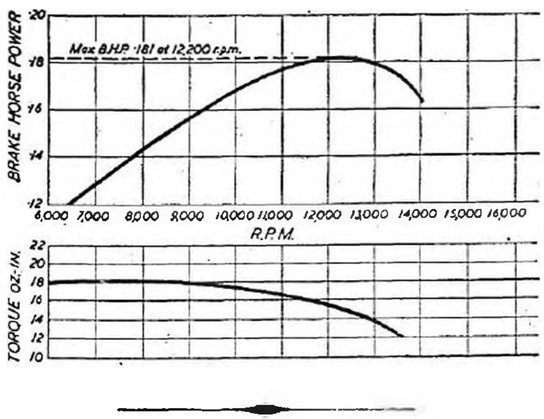
Retail price 66/6

Displacement: 2.4
Bore: .570. Sroke: .562 Bore/stroke ratio: 1.01
Bare weight: 4 oz.
Max. B.H.P.: .181 B.H.P. at 12,200 r.p.m.
Power rating: .0725 B.H.P. per c.c.
Power/weight ratio: .045 B.H.P. per oz.

Material Specification:
Crankcase: L.M.2
Cylinder: Meehanite
Cylinder jacket: Dural
Piston: Meehanite
Contra-piston: Meehanite
Connecting rod: Dural
Crankshaft: S14. Case hardened
Crankshaft bearing: Meehanite bush

PROPELLER dia. pitch	R.P.M.
9 × 6	9,500
9 × 4 (Stant)	10,250
9 × 4 (K-K)	10,000
8 × 6 (Stant)	10,850
8 × 6 (K-K)	10.600
8 × 6 (Trucut)	10,500
7 × 6 (Stant)	12,000
7 × 6 (K-K)	11,800
9 × 4 Plastic	7,800

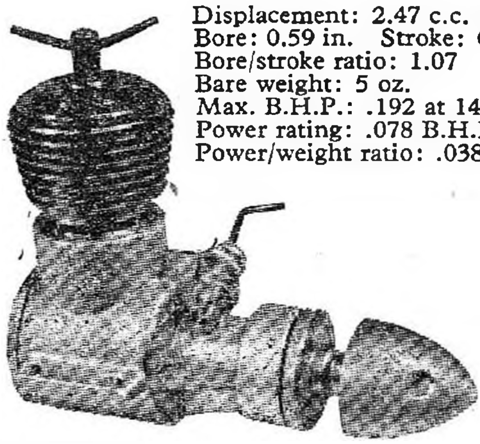
Fuel: Mercury No. 8



TAIFUN TORNADO 2.5 c.c.

Manufacturers:

Johannes Graupner, Kircheim-Teck (Germany).

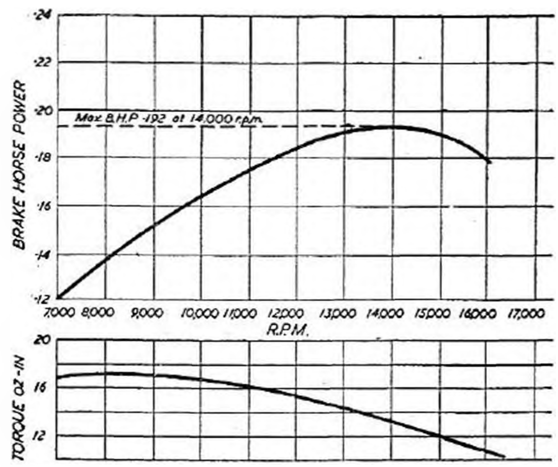


Displacement: 2.47 c.c. (0.15 cu. in.)
Bore: 0.59 in. Stroke: 0.59 in.
Bore/stroke ratio: 1.07
Bare weight: 5 oz.
Max. B.H.P.: .192 at 14,000 r.p.m.
Power rating: .078 B.H.P. per c.c.
Power/weight ratio: .038 B.H.P. per oz.

Material Specification:
Crankcase: Die-cast light alloy
Cylinder: Nickel-chrome steel
Piston: Cast iron
Contra-piston: Nickel-chrome steel
Crankshaft: Alloy steel
Con. rod.: Dural
Bearings: Two ball races

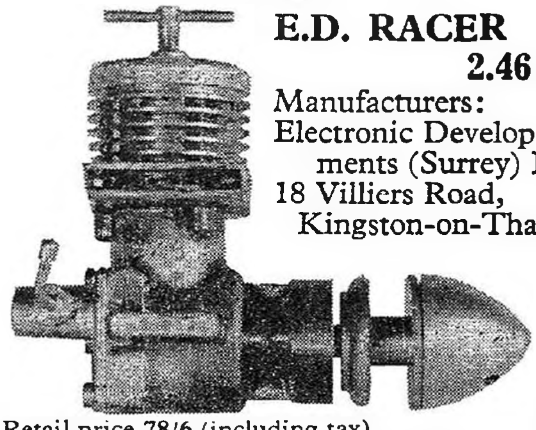
PROPELLER dia. pitch	R.P.M.
11 × 5 (Stant)	6,000
9 × 4 (Stant)	10,000
21 × 15 cm.	11,500
9 × 6 (Trucut)	8,200
7 × 6 (Stant)	12,000

Fuel: Equal parts ether, paraffin and castor oil



E.D. RACER 2.46 c.c.

Manufacturers:
Electronic Developments (Surrey) Ltd.,
18 Villiers Road,
Kingston-on-Thames.

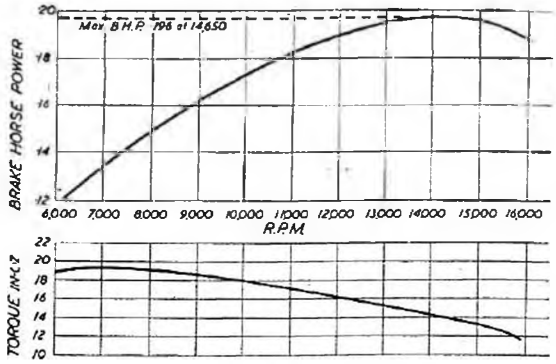


Retail price 78/6 (including tax)
Displacement: 2.46 c.c. (.150 cu. in.)
Bore: .590 in.
Stroke: .550 in.
Bore/stroke ratio: 1.07
Bare weight: 5⅜ oz.
Max. B.H.P.: .196 B.H.P. at 14,650
Power rating: .08 B.H.P. per c.c.
Power/weight ratio: .0365 B.H.P. per oz.

Material Specification.
Crankcase: Die-cast magnesium alloy (aluminium alloy back-plate.
Disc: Aluminium
Cylinder: Steel S.14
Cylinder jacket: Dura anodisec
Piston: Cast iron
Contra-piston: Steel
Connecting rod: Dura RR56 forging
Crankshaft: Steel S.1
Crankshaft bearings: Two ball journals

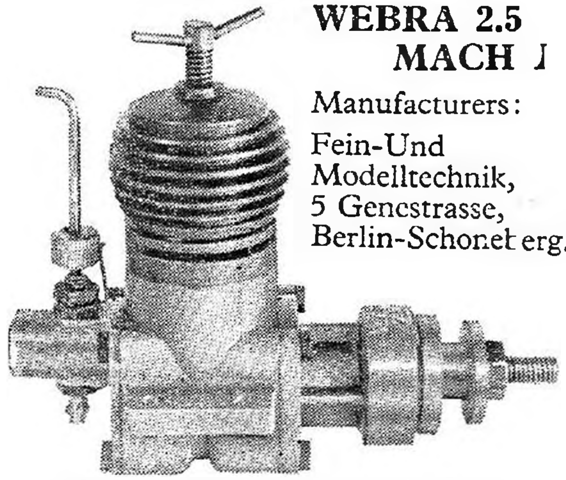
Propeller	R.P.M.
dia. pitch	
8 × 4*	11,000
8 × 6*	10,750
8 × 6 (Trucut)	11,600
8 × 6 (Stant)	11,800
8 × 6 (K-K)	11,000
9 × 4 (Stant)	10,800
9 × 4 (K-K)	10,500
9 × 6 (Stant)	9,800
9 × 6 (K-K)	9,350
10 × 4	9,700
10 × 6	7,800
11 × 6	6,500
11 × 8	5,750

Fuel: Mercury No. 8. * Plastic



WEBRA 2.5 MACH I

Manufacturers:
Fein-Und Modelltechnik,
5 Genestrasse,
Berlin-Schoneberg.



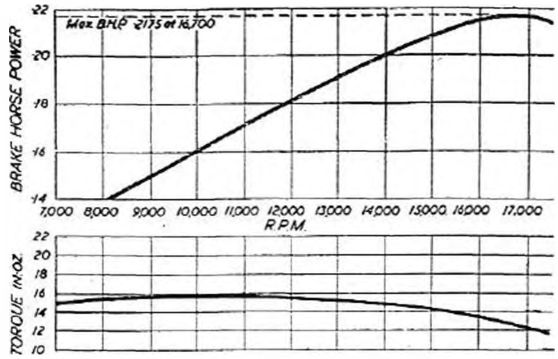
Retail price in U.K. £4 10s. for export only

Displacement: 2.47 c.c. (.15 cu. in.)
Bore: 15.5 mm. (.61 in.)
Stroke: 13 mm. (.51 in.)
Bore/stroke ratio: 1.2
Bare weight: 4½ oz.
Power rating: .088 B.H.P. per c.c.

Material Specification:
Crankcase: Die-cast aluminium alloy
Crankcase bearing: Twin ball races
Cylinder: Steel
Cylinder jacket: Duralumin
Piston: Cast iron
Piston: Cast iron (pointed dome)
Contra-piston: Steel
Con. Rod:
Connecting rod: Duralumin
Crankshaft: Hardened steel

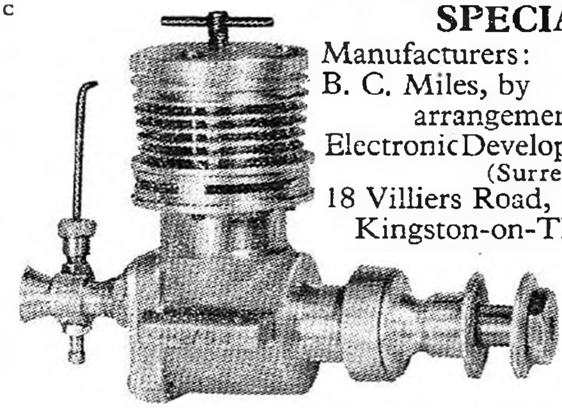
Propeller	R.P.M.
dia. pitch	
9 × 4 (Stant)	9,550
9 × 4 (Truflo)	9,500
7 × 5 (Whirlwind)	13,250

Fuel: used Mercury No. 8



MILES 5 c.c. SPECIAL

Manufacturers:
B. C. Miles, by arrangement with Electronic Developments (Surrey) Ltd.,
18 Villiers Road,
Kingston-on-Thames.

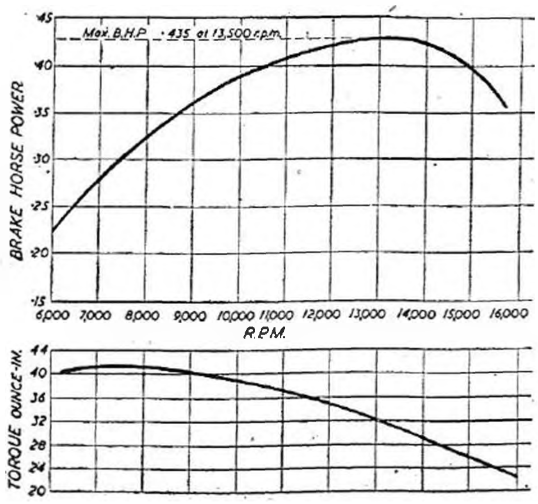


Retail price: £8 6s. 3d., water-cooled £9 19s. 6d.
Displacement: 4.92 c.c. (.30 cu. in.) Bore: .781 in.
Stroke: .625 Bore/stroke ratio: 1.25 Bare weight: 10 oz.
Max. B.H.P.: .435 at 13,500 r.p.m.
Max. torque: 41.8 oz.-in. at 7,300 r.p.m.
Power rating: .0885 B.H.P. per c.c.
Power/weight ratio: .0435 B.H.P. per oz.

Material Specification:
Crankcase: Cast light alloy, DTD 424
Rotor disc: aluminion
Cylinder Centrifugally Cast Iron
Cylinder jacket: Dural
Cylinder head: Dural
Contra-piston: Cast iron
Piston: Cat iron
Connecting rod: Dural
Crankshaft: Steel S.14
Crankshaft bearing: Two ball races

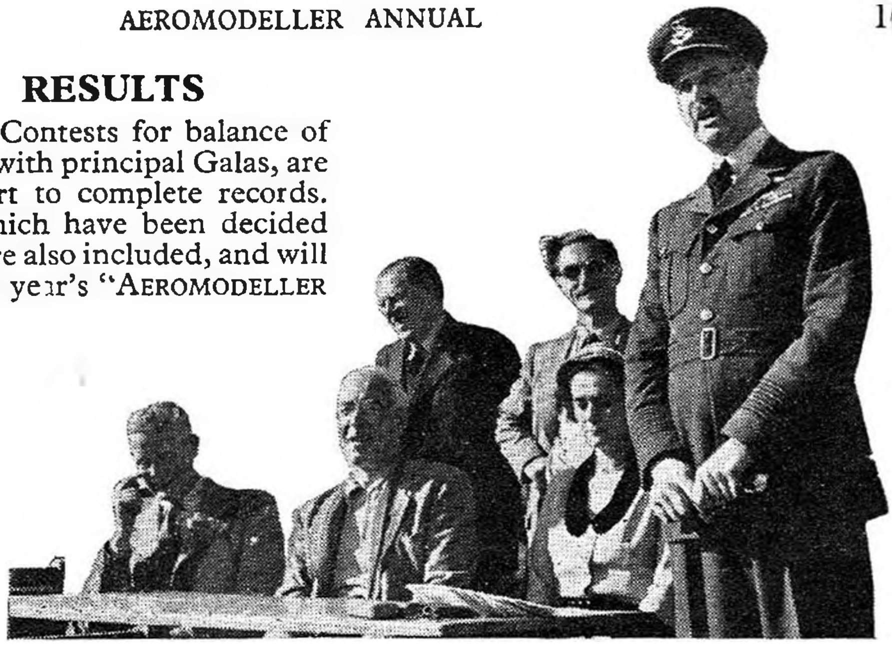
Propeller	R.P.M.
dia. pitch	
11 × 8 (Whirlwind)	7,100
12 × 6 (Trucut)	6,750
10 × 8 (Truflex)	8,500
10 × 8 (Whirlwind)	8,500
11 × 6 (Whirlwind)	8,800
11 × 5 (Stant)	10,000
9 × 6 (Stant)	12,600
10 × 4 (Stant)	13,000
8 × 6 (K-K)	14,700

Fuel: Mercury No.8



CONTEST RESULTS

RESULTS of S.M.A.E. Contests for balance of 1954 Season, together with principal Galas, are included in this report to complete records. Those 1955 events which have been decided before going to press are also included, and will be completed in next year's "AEROMODELLER ANNUAL".



Group Captain B. A. Chacksfield, O.B.E., at the S.M.A.E. Nationals Prizegiving at R.A.F. Waterbeach with Mrs. Chacksfield and S.M.A.E. officials.

August 1st and 2nd—NORTHERN GALA, Darlington

Frog Senior Cup (open power)

1 Smith, T.	English Electric	11 : 54
2 Caster, M.	Country Member	11 : 44
3 French, G.	Country Member	10 : 30

RIPMAX TROPHY. Radio Control

1 Allen, S.	Bushey Park
2 Parkinson, G.	Kendal
3 Hemsley, O.	Bushey Park

COMBAT

Perkins, —	Meanwood

DAVIES TROPHY. Team Race B

Steward, L.	West Essex	8 : 25

PAALOAD. 1.5 c.c.

1 Faulkner, B.	Cheadle	5 : 36
2 Jays, V.	Country Member	2 : 40
3 Woods, T.	St. Albans	2 : 35

FLIGHT CUP. Open Rubber

1 O'Donnell, J.	Whitefield	12 : 00
2 Firth, R.	York	9 : 01
3 Upson, G.	Northwick Park	7 : 21

C.M.A. CUP. Open Glider

1 O'Donnell, H.	Whitefield	10 : 26
2 Peters, C.	Northwick Park	10 : 24
3 Guest, P.	Barnsley	9 : 45

AEROMODELLER TROPHY. Radio Control

1 Allen, S.	Bushey Park
2 Hemsley, O.	Bushey Park

DAVIES TROPHY. Team Race A

Yeldham, G.	Belfairs	10 : 03

SPEED

Class I	Wright, P.	92 m.p.h.
Class II	Powell, D.	124 m.p.h.

OPEN POWER

1 Lanfranchi, S.	Bradford	7 : 12
2 Chester, C.	Country Member	3 : 50
3 French, G.	Country Member	3 : 20

U.K. CHALLENGE

Power			
England	26 : 57	Scotland	22 : 27
Rubber			
Scotland	34 : 31	England	31 : 45
Glider			
England	30 : 46	Scotland	16 : 34

August 7th/8th—INDOOR NATIONALS, Cardington

Agg. of three Flights:

Copland, R.	Northern Heights				*Total*
		19 : 00	19 : 58	19 : 59*	58 : 57
Reid, P.	Birmingham				
		17 : 16	17 : 44	21 : 09*	56 : 09
Parham, R.	Worcester				
		19 : 19*	16 : 32	16 : 38	52 : 29
Monks, R.	Birmingham				
		16 : 36	18 : 03*	17 : 41	52 : 20

* Denotes best individual contest flights.

July 4th—HAMLEY TROPHY

Power (22 *entries*) *Decentralised*

1 Marsh, C.	St. Albans	10 : 23
2 Painter, D.	Henley	9 : 47
3 McMasters, J.	Glasgow M.A.C.	9 : 29
4 Muse, A.	Novocastria	8 : 47
5 Waldron, J.	Henley	8 : 41
6 Pannett, J.	Bradford	8 : 06

August 29th—KEIL TROPHY

Open Power Ratio (31 *entries*) *Decentralised*

1 Painter, D.	Henley	10 : 45
2 Eggleston, B.	Leeds	9 : 27
3 Taylor, S.	W. Hants	9 : 25
4 Brown, P.	Brighton	8 : 22
5 Jays, V.	C.M.	7 : 58
6 Nicols, A.	Southern Cross	7 : 53
Buskell, P.	Surbiton	7 : 53

August 29th—FROG JUNIOR

Open Rubber/Glider (12 *entries*) *Decentralised*

1 Crossley, P.	Blackheath	8 : 36
2 Williams, A.	Croydon	7 : 12
3 Larcey, P.	Henley	6 : 47
4 Burwood, R.	Blackheath	6 : 12
5 O'Donnell, H.	Whitefield	5 : 16
6 Syme, A.	Northwick	5 : 03

September 19th—GUTTERIDGE TROPHY

1955 *Wakefield Eliminators* *Area Centralised* (134 *entries*)

1 O'Donnell, J.	Whitefield	14 : 57
2 Anderton, A.	Cheadle	14 : 22
3 Trainer, J.	Whitefield	14 : 15
4 Bladwin, R.	Wigan	13 : 57
5 { Miller, C.	Bradford	13 : 48
{ Thomas, G.	Slough	13 : 48

September 19th—MODEL ENGINEER CUP

Team Glider *Area Centralised* (31 *entries*)

1 West Middlesex	32 : 08
2 Croydon	31 : 44
3 Northwick Park	25 : 29
4 Surbiton	25 : 12
5 Chelmsford	24 : 53
6 Belfairs	24 : 48

September 26th—ALL BRITAIN RALLY, Radlett, Herts

Rubber

1 Palmer, J	Croydon	6 ; 00; Fly-off

2	Woolls, G.	Bristol	6 : 00
	Glider		
1	King, Mrs. P. R.	Belfairs	4 : 34
	Power		
1	Brooks, A.	Grange	5 : 01
	Seaplane, Rubber		
1	Taylor, P. T.	Croydon	3 : 33
	Seaplane, Power		
1	Jays, V.	Country Member	1 : 21
	"Aeromodeller" Trophy—Best Seaplane		
1	Taylor, P. T.	Croydon	3 : 33
	Tailless, Rubber		
1	Woolls, G.	Bristol	2 : 55
	Tailless Glider		
1	Smith, F.	Southern Cross	1 : 34
	Tailless Power		
1	Fisher, O. F. W.	I.R.C.M.S.	1 : 01
	Concours d'Elegance—Scale		
1	Briggs, A. J.	Park M.A.L.	"Lincoln"
	Clipper Cargo		
1	Moulton, R.	West Herts	13½ oz.
	Radio Control Aerobatics		
1	Hemsley, O. E.	Bushey Park	32 pts.
	Team Race—Class "A"		
1	Smith, M.	High Wycombe	
	Team Race—Class "B"		
1	Muscutt, K.	West Essex	
	Combat		
1	Taylor, C.	West Essex	
	"Model Aircraft" Trophy—Rally Championship		
	Woolls, G.	Bristol	
	Hertford Championship		
	Weston, A.	West Herts	
	International Jetex Contest		
1	O'Donnell, J.	English Electric	14 : 31
	"Aeromodeller" 1 c.c. PAA-load		
1	Faulkner, B. T.	Cheadle	3 : 38

October 3rd—K. & M.A.A. CUP
1955 *A/2 Eliminators* — *Area Centralised*
(263 *entries*)

1	Midgley, E.	Barnsley	13 : 29
2	Thompson, E.	Northampton	13 : 12
3	O'Donnell, J.	Whitefield	12 : 50
4	Remington, —	Loughborough	12 : 34
5	Leech, D.	Northwick Park	12 : 15
6	North, E.	Halifax	12 : 13

October 3rd—HALFAX TROPHY
1955 *Power Eliminators* — *Area Centralised*
(153 *entries*)

1	Parrott, J.	Whitefield	14 : 38
2	Painter, D.	Henley	13 : 53
3	Hutton, G.	Wallasey	13 : 35
4	Gaster, M.	Country Member	13 : 27
5	Donald, I.	Dunfermline	13 : 11
6	French, G.	Country Member	13 : 04

PLUGGE CUP

Croydon	1326 : 48
Birmingham	1325 : 133
West Middlesex	1117 : 655
Cheadle	1012 : 723
Leeds	1000 : 930
Whitefield	970 : 908

1955 CONTEST RESULTS

March 20th—GAMAGE CUP
Unrestricted Rubber — *Decentralised*
(137 *entries*)

1	Bennett, E.	Croydon	11 : 52
2	Goodall, A.	Grange	11 : 35
3	O'Donnell, J.	Whitefield	11 : 31
4	Upson, G.	Northwick Park	11 : 02
5	Miller, C.	Bradford	10 : 54
6	Oliver, K.	Foresters	10 : 24

March 20th—PILCHER CUP
Unrestricted Glider — *Decentralised*
(270 *entries*)

1	Woodward, T.	Foresters	12 : 00
2	Lipscombe D.	R.A.F.	11 : 00
3	Roberts, G.	Five Towns	10 : 42
4	Laxton, D.	Oundle	10 : 27
5	Eckersley, J.	Bradford	10 : 21
6	Brown, K.	York	10 : 10

April 3rd—S.M.A.E. CUP
2nd A/2 Eliminators — *Area Centralised*
(228 *entries*)

1	Hannay, J.	Wallasey	12 : 02
2	Harris, B.	Prestwick	12 : 01
3	Guest, P.	Barnsley	11 : 49
4	O'Donnell, J.	Whitefield	11 : 47
5	Yeabsley, R.	Croydon	11 : 11
6	Hinds, S.	Wallasey	10 : 59

FARROW SHIELD
(27 *Clubs*)

1	Croydon	39 : 14	4	Halifax	25 : 09
2	Leeds	32 : 03	5	Anglia	21 : 57
3	Whitefield	30 : 59	6	Belfairs	21 : 61

April 3rd—WOMEN'S CHALLENGE CUP
Unrestricted Rubber/Glider — *Area Centralised*
(10 *entries*)

1	Knight, Miss D.	North Kent Nomads	6 : 50
2	Franklin, Miss E.	Blackpool	5 : 27
3	Morgan, Mrs. S.	Wigan	5 : 15
4	King, Mrs. M. A.	Belfairs	4 : 41
5	Fittness, Mrs.	Chester	4 : 30
6	Moulton, Mrs. B.	West Herts	4 : 19

April 3rd—JETEX CHALLENGE CUP
Jetex — *Area Centralised*
(29 *entries*)

1	Ridyard, K.	Timperley	23.83 ratio
2	Pressnell, M.	Belfairs	21.59 „
3	Ranson, L.	Hornchurch	20.39 „
4	O'Donnell, J.	Whitefield	18.30 „
5	Hardwick, P.	Wolves	17.14 „
6	Dowsett, I.	West Middlesex	14.18 „

April 17th—CONTROL LINE SPEED ELIMINATORS *Centralised*
Class I

1	Wright, P.	St. Albans	90.9 m.p.h.
2	Smith, M.	High Wycombe	87.4 „
3	Woods, D.	St. Albans	83.8 „
4	Edmonds, R.	High Wycombe	83.8 „
5	Gibbs, R.	East London	79.6 „

April 24th—WESTON CUP
2nd Wakefield Eliminators — *Area Centralised*
(122 *entries*)

1	O'Donnell, J.	Whitefield	15 : 00+9 : 32
2	Cooper, W.	Whitefield	15 : 00+3 : 36
3	Anderton, A.	Cheadle	15 : 00+2 : 45
	Knight, H. J.	N. Kent Nomads	15 : 00+2 · 45
5	Palmer, J.	Croydon	15 : 00+2 : 42
6	Lennox, R.	Birmingham	14 : 52

April 24th—ASTRAL TROPHY
2nd Power Eliminators — *Area Centralised*
(217 *entries*)

1	Petty, C.	Walsall	15 : 00+2 : 58
2	Bedale, R.	Walsall	14 : 42
3	Kent, P. S.	C.M.	14 : 15
4	Lanfranchi S.	Bradford	14 : 10
5	Blackmore, J.	Grange	13 : 45
6	Harrison, I.	Cheadle	13 : 38
	Gaster, M.	C.M.	13 : 38

May 8th—RIPMAX TROPHY
Held at R.A.F. Debden
Radio Control — *Centralised*
(11 *entries*)

1	Honnest Redlich, G.	Bushy Park	50 points
	Hemsley, O.	Bushy Park	50 „
3	Allen, N.	West Essex	37½ „
4	Rhodes, M.	Harrow	25 „
	Crowe, C.	Harrow	25 „

May 15th—HAMLEY TROPHY
Power — *Decentralised*
(28 *entries*

1	Waldron, J.	Henley	8 : 24
2	Painter, D.	Henley	8 : 18
3	Worley, N.	Southampton	8 : 11
4	Upson, G.	Northwick Park	8 : 09
5	Bedale, R.	Walsall	7 : 20
6	Willmott, D.	Belfairs	7 : 03

May 28th, 29th, 30th—BRITISH NATIONALS
Held at R.A.F. Waterbeach, Nr. Cambridge

MODEL AIRCRAFT TROPHY—Rubber

1	North, R.	Croydon	12 : 00+9 : 12
2	Bennett, E.	Croydon	12 : 00+8 : 52
3	Upson, G.	N'thwick Pk.	12 : 00+5 : 49
4	Monks, R.	Birmingham	12 : 00+4 : 35
5	Wood, D.	Luton	12 : 00+1 : 40
6	O'Donnell, J.	Whitefield	11 : 55

LADY SHELLEY CUP—Tailless

1	Smith, F. C.	Southern Cross	7 : 42
2	Marshall, J.	Hayes	7 : 37
3	Crawshaw, I.	St. Albans	3 : 56
4	Gates, G.	Southern Cross	3 : 47
5	Headley, J.	English Electric	3 : 26
6	Donald, K.	Southern Cross	2 : 58

SHORT CUP—PAA-Load

1	Monks, R.	Birmingham	7 : 17
2	Lucas, I.	Brighton	5 : 00
3	Hayward, L.	Chingford	4 : 43
4	Roberts, G. L.	Lincoln	4 : 28
5	Ward, R.	Croydon	3 : 58
6	Longstaffe, A.	De Havilland (Hatfield)	3 : 19

THURSTON CUP—Glider

1	Painter, D.	Henley	12 : 00
2	Latter, D.	Men of Kent	10 : 44
3	Aspinal, M.	Rugby	10 : 19
4	Waldron, J.	Henley	10 : 19
5	Crawshaw, J.	St. Albans	9 : 37
6	Starker, M.	Seekers	9 : 07

S.M.A.E. TROPHY—Radio Control

1	McDonald, A.	West Essex	306 points
2	Hemsley, E.	Bushy Park	275 „
3	Howard Boys	Northampton	201 „

TAPLIN TROPHY—Radio Control

1	Howard Boys	Northampton	279 points
2	Dance, C.	North Kent Nomads	238½ „
3	Higham, R.	C.M.	237 „

DAVIES TROPHY

Class A			
1	Edmonds, D.	High Wycombe	9 : 58
Class B			
1	McNess	West Essex	7 : 09

SUPER SCALE

1	Evans, A. W.	Bromley	79 points
2	Ball, P.	Leicester	78 „
3	Russell, P.	C.M.	73 „
4	Whittaker, P.	Associate	70 „
5	McCarthy, J.	Southend	66 „
6	Babb, P.	Northwick Park	65 „

C/L SPEED

Class I			
1	Wright, P.	St. Albans	95.16 m.p.h.
2	R. Edmonds	H. Wycombe	94.08 „
3	Lawton, S.	Macclesfield	84.08 „
Class II			
1	Powell, D.	East London	127.1 m.p.h.
2	Gibbs, R.	East London	117.5 „
3	Foxx, M.	U.S.A.	101.2 „
Class III			
1	Davenport, R.	East London	146.2 m.p.h.
2	Marsh, —	Salisbury	117.1 „
Jet			
1	Russell, P.	Associate	131.6 m.p.h

GOLD TROPHY—C/L Stunt

1	Russell, P.	Associate	312 points
2	Lloyd, —	R.A.F.	281 „
3	Piacentini, A.	Salisbury	280 „
4	Ridgway, P.	Macclesfield	268 „
5	Morley, W.	West Essex	264 „
6	Jubb, P.	Crosby	184 „

SIR JOHN SHELLEY CUP—Power

1	Rowsell, K.	Laindon	12 : 00
2	Posner, D.	N.W. Middlesex	11 : 52
3	Harrison, I.	Cheadle	11 : 14
4	Stenning, D.	Reading	10 : 55
5	Donald, K.	Southern Cross	9 : 56
6	Abbey, R.	Coventry	9 : 45

BOWDEN TROPHY

1	Swinden, R.	Darlington	1,675 points
2	West, J.	Southern Cross	1,530 „
3	Ellis, L.	R.A.F.	975 „
4	Jackson, G.	C.M.	950 „
5	Durrant, I.	Epsom	940 „
6	Pressnell, M.	Belfairs	900 „

June 26th—NORTHERN HEIGHTS GALA
Held at R.A.F. Halton

FLIGHT TROPHY
Welbourne, E. R. — Hayes — 8 : 00+2 : 00

FAIREY CUP
O'Donnell, J. — Whitefield — 8 : 00+4 : 59

THE QUEEN ELIZABETH CUP
Aldridge, D. — Letchworth — 972 points

THURSTON HELICOPTER TROPHY
Ingram, C. M. — Southampton — 232 points

DE HAVILLAND TROPHY
Gunter, B. C. — B.A.O.C. — 8 : 00

KEIL KRAFT COMBAT TROPHY
Smith, M. G. — High Wycombe

R.A.F. M.A.A.
Boy Entrant Webb — Cosford

R.A.F. FLYING REVIEW CUP
Fox, J. — Hatfield

CONCOURS D'ELEGANCE

Power	*Flying Scale*	*General Flying*	*Unorthodox*
Gaster, M.	Briggs, A.	Read, C.	Marshall, J.

AEROMODELLER CUP—Gala Champion
Welbourn, E. R. — Hayes

July 3rd—CLWYD SLOPE SOARING

A/2 Class		
Hotchkiss	Wallasey	4 : 59
Senior Open Class		
Whitehurst, D.	Cheadle	4 : 23
Junior Open Class		
Jackson, B.	Cheadle	2 : 53
R/C Class		
Nield, W.	Cheadle	

July 3rd—KEIL TROPHY
Power — *Decentralised*
(26 *entries*)

1	Buskell, P.	Surbiton	9 : 51
2	Worley, N.	Southampton	9 : 48
3	Webster, J.	Farnborough	8 : 46
4	Painter, D.	Henley	7 : 46
5	Parsons, R.	Prestwick	7 : 30
6	McNulty, F.	Leeds	6 : 43

June 18th/19th—INTERNATIONAL TRIALS
Held at R.A.F. Odiham, Hants

A/2 Glider Trials			
1	Lefever, G.	Country Member	12 : 59
2	O'Donnell, J.	Whitefield	11 : 55
3	Gilroy, R.	Croydon	11 : 29
4	Yeabsley, D.	Croydon	11 : 25
5	Manville, P.	Bournemouth	11 : 12
5	Chadwick, J.	Ashton	11 : 12
6	Larcey, P.	Henley	10 : 37
Power Trials			
1	Buskell, P.	Surbiton	14 : 30
2	Parrott, J.	Whitefield	14 : 17
3	Gaster, M.	Country Member	14 : 13
4	Muddell, A.	Brighton	14 : 21
5	Painter, D.	Henley	13 : 49
6	Draper, R.	Coventry	13 : 43
Wakefield Trials			
1	Holland, F.	Swansea	14 : 27
2	O'Donnell, J.	Whitefield	14 : 05
3	Read, P.	Birmingham	13 : 38
4	Knight, H. J.	Nth. Kent Nomads	13 : 35
5	O'Donnell, H.	Whitefield	13 : 22
6	Lennox, R.	Birmingham	13 : 17

July 3rd—FROG JUNIOR TROPHY

Unrestricted Rubber/Glider — *Decentralised*

(7 *entries*)

1	Burwood, R.	Blackheath	9 : 22
2	King, P.	Croydon	6 : 02
3	Larcey, P.	Henley	4 : 00

July 3rd—DAILY DISPATCH RALLY

Power		
Lord, E.	Accrington	8 : 09
Glider		
Hinds, S.	Wallasey	5 : 28
Rubber		
Howarth, R.	Whitefield	8 : 31
Jetex		
Pratt, K.	Ashton	30.9 Ratio
1.5 *PAAload*		
Posner, D.	West Middlesex	1 : 58
Class A Team Race		
Thompson, J.	Foresters	
Women's Cup		
Coppuck, Miss M.	English Electric M.A.C.	
Flying Scale—E. J. Riding Trophy		
Bridgewood, J.	Doncaster	
Senior Champion		
O'Donnell, H.	Whitefield	
Junior Champion		
Northrop, J.	Leeds	

July 31st—NORTHERN GALA

Held at Croft, Nr. Darlington

(27 *entries*)

FLIGHT CUP

Unrestricted Rubber — *Centralised*

1	Cartwright, J.	Hull Pegasus	12 : 00
2	O'Donnell, J.	Whitefield	11 : 52
3	Finlayson, J.	Glasgow	11 : 30
4	O'Donnell, H.	Whitefield	11 : 13
5	Bennett, E.	Croydon	11 : 12
6	Fairless, S.	Novocastria	10 : 23

FROG SENIOR CUP

Power (40 *entries*)

1	Upson, G.	Northwick Park	12 : 00 + 13 : 26
2	Jays, V.	Country Member	12 : 00 + 6 : 52
3	Archer, W.	Cheadle	12 : 00
4	Spurr, A.	Stockton	11 : 59
5	Howarth, R.	Whitefield	11 : 54
6	Eggleston, B.	Leeds	11 : 40

C.M.A. CUP

Glider (49 *entries*)

1	Harris, B.	Prestwick	12 : 00 + 11 : 19
2	Simcock, J.	Northwick Park	12 : 00 + 10 : 26
3	Farrar, A.	Pontefract	12 : 00 + 2 : 36
4	Chadwick, J.	Ashton	10 : 59
5	Clav, C.	York	10 : 52
6	Morley, D.	Cresswell	10 : 42

PAN AMERICAN CUP

1 *c.c. PAAload* (9 *entries*)

1	Faulkner, B.	Cheadle	3 : 49
2	Firth, R.	York	2 : 57
3	Morgan, D.	Wigan	2 : 27
4	Willars, D.	Whitefield	1 : 48
5	Mullar, P.	Country Member	0 : 59

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