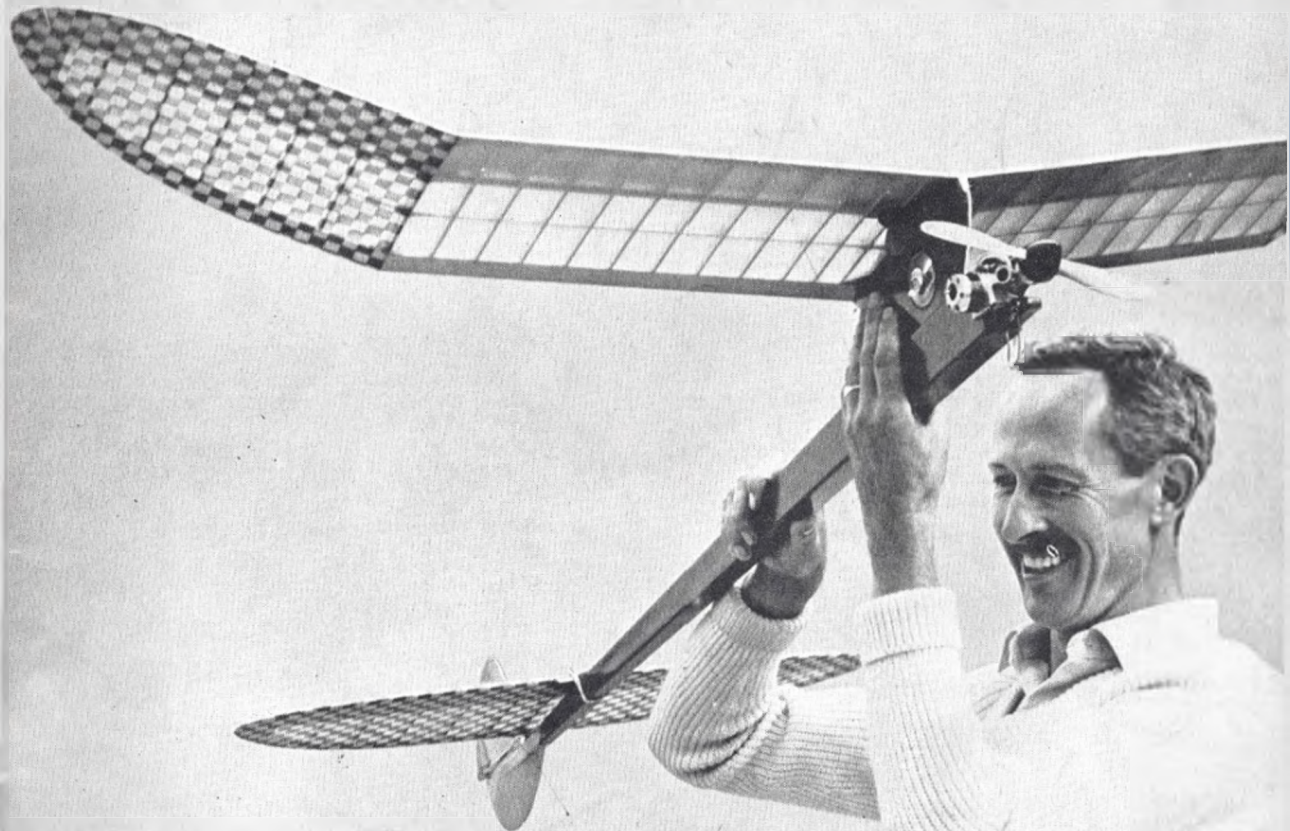
WINGS CLUB FOR BOYS SEE INSIDE

SEPTEMBER 1961

1'6

MODEL aircraft



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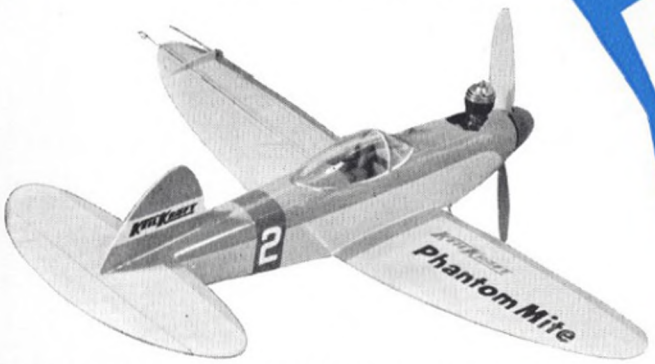

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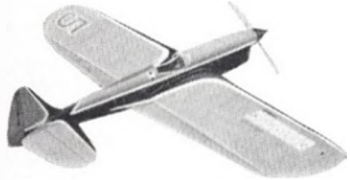

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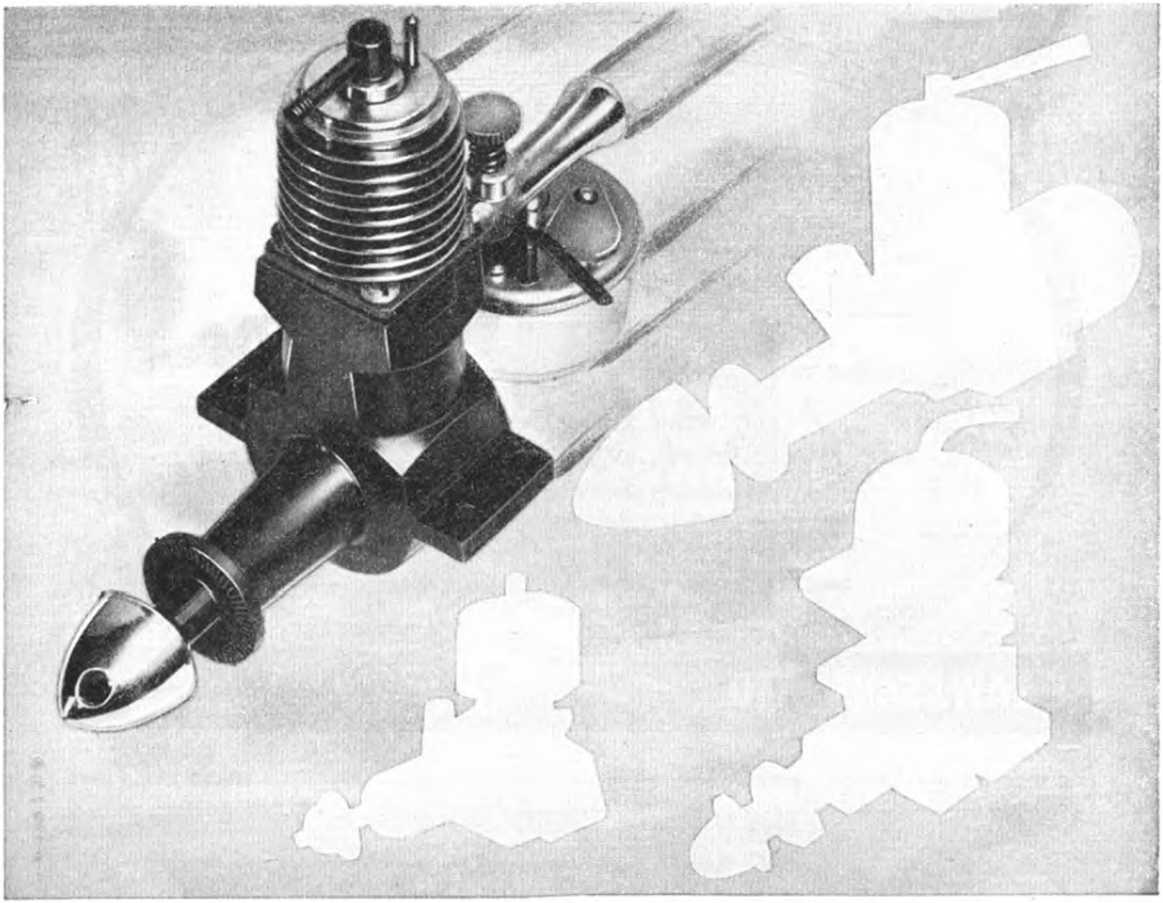

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MODEL aircraft

SEPTEMBER 1961

No. 243 VOLUME 20

The official Journal of the SOCIETY OF MODEL AERONAUTICAL ENGINEERS

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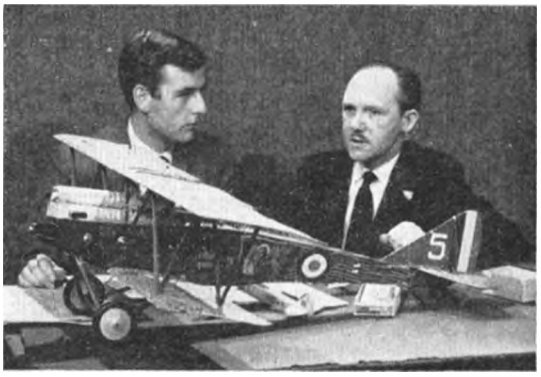
Here and There

AEROMODELLING is rarely featured on television in this country, and when it is, the approach frequently emphasises the more spectacular [*sic*] aspects, particularly crashes! We were, therefore, very keen to take up a recent offer of three "spots" on the A.T.V. network programme "Lucky Dip." The programme audience is predominantly junior and our first airing dealt with getting started, on the right lines, with a simple model. The following weeks we gave some trimming and flying hints.

MODEL AIRCRAFT's Assistant Editor, Doug McHard, who handled these programmes, is seen in our photo with "Lucky Dip's" Howard Williams (left), discussing Capt. Cesare Milani's beautiful Ansaldo S.V.A. (not recommended as a first attempt!), with which the show was introduced. Incidentally, the Ansaldo can be seen at the M.E. Exhibition (see separate paragraph below).

M.E. Exhibition

A PRE-VIEW of some of the many excellent models which will be on show at the Model Engineer Exhibition, appears on page 271 of this issue. There is still plenty of time to see the originals, as well as the many other models, as the exhibition is open daily from 16th/26th



August (except Sunday), 11 a.m.-9 p.m. at the Central Hall, Westminster, London, S.E.1.

R/C Colossus

OUTSIZE in radio models, pictured right, was built by American team race enthusiast Darrel Dolgner, as a test bed for electronic devices, produced by his employers, Diamond Ordnance Laboratories. Wingspan is 14 ft. with a 10 ft. fuselage and orthodox construction utilises balsa and spruce, with nylon covering.

When the photos were taken, a single cylinder lawnmower motor, which gave 2½ h.p., was installed, but as more "oomph" was needed, it was converted to a twin, by fitting another identical motor, with the shafts of the two coupled. Power is now nearly 6 h.p. and r.p.m. is variable from 1,000 to 8,000. Radio control is by Walt Good's dual proportional system, with a separate escapement for motor control.

Darrel tells us that all flights have to be R.O.G., as 50 lb. of model, plus 35-40 lb. of payload, is a bit of a handful to hand launch. Some 100 ft. of runway is necessary for take off, which is at about 20 m.p.h., flying speed, on full throttle, being some 40 m.p.h. and the model will climb at 45 deg. as soon as it "unsticks."

Contest Criticism

AT one time the success, or otherwise, of a model contest was judged upon the numerical support it attracted; the bigger the entry the greater the success. In the popular rally events this criterion still holds good, but at the same time there is now a tendency to be more critical about the quality of the flying as a whole. Whereas, perhaps, the focus was on the top performing men, with nothing much expected from the rest of the field, we now look for a reasonable standard of competence from the bulk of the competitors.

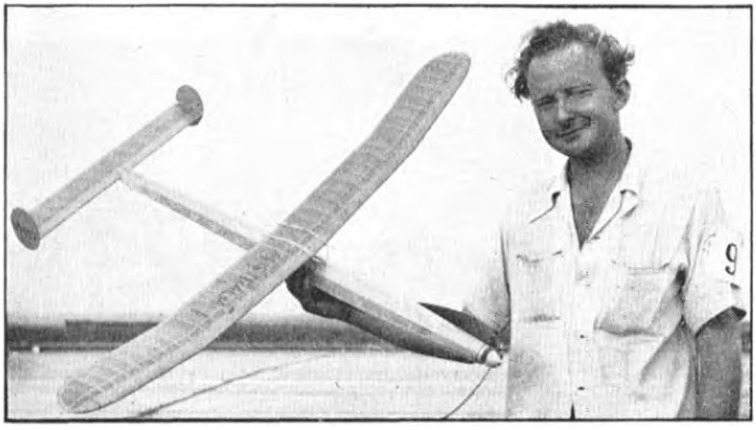
In certain events, such as radio and C/L, which work to a tight schedule, a high standard of flying is not just a pleasing abstraction, but a necessary factor in the smooth running of the contest. This is particularly so in events which are judged rather than flight recorded, and it becomes a responsibility of the would-be competitor to determine whether or not he is sufficiently experienced to give a good account of himself, and not hamper the overworked officials with a frivolous or futile display.

F/F events continue to give ample scope for the less experienced modeller. Indeed, the rally takings would look very sick, indeed, if the field was limited to potential winners only. Even so, the standard of flying has risen to a point where less patience is felt towards the entrant who uses the contest as a trimming session, or who wastes time in long-winded and uncertain preparation. Power events are the most bedevilled in this respect where a combination of too much engine and too little experience endangers other airfield users and discredits the hobby.

Good contest performance is the end product of a lot of practice and much careful preparation. There is no quick route to success, but there is all the satisfaction in the world from acquitting yourself well in a contest, even if you don't go home with the cup.

Alan King

HIS many friends will be deeply grieved to hear of the death of Alan King at the early age of 33. Among the vanguard of well-known Australian modellers to visit England and make their mark among British modellers, he only returned to Australia at the end of 1960, after six years over here. A Wakefield specialist, Alan won the contest in 1954 and was well in the running on several subsequent occasions. He was Champion of Australia several times and, in fact, won the Victoria Wakefield event only a few weeks before his death on June 22nd. His modelling friends from all over the world join us in extending sympathy to his wife and daughter.



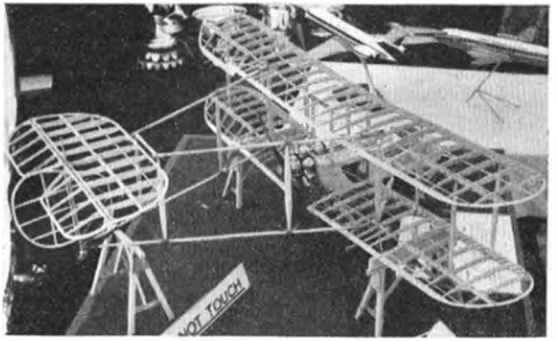
Alan after winning the 1954 Wakefield.

On the Cover

ONLY competitor at the trials (reported elsewhere in this issue) to return max's with a consistency that seemed infallible was George French, who was flying this model, which is powered by an O.S. Max D-15. The incredible performance of this motor is detailed in this month's Engine Test and, no doubt, its sheer b.h.p. contributed significantly to French's success.

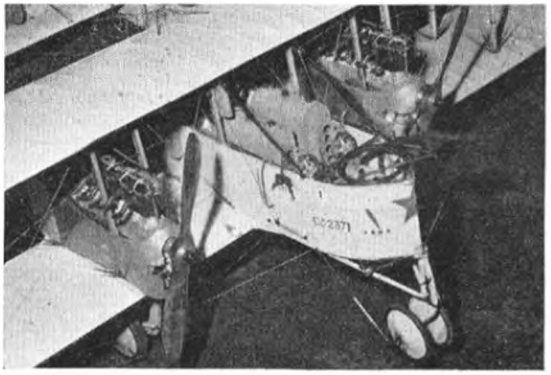
PREVIEW

Photographs of a few of the aircraft models on display at the MODEL ENGINEER EXHIBITION



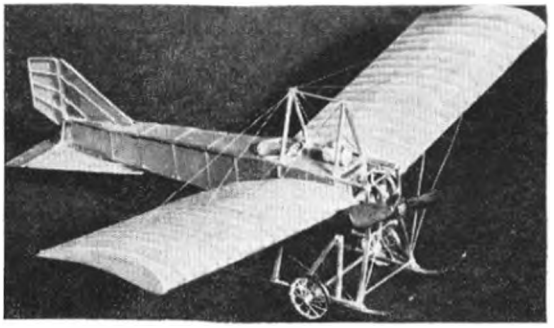
This 1/12th (at 6 ft. wingspan, quite the largest of the "solids") scale Vickers Vimy in Imston Airline markings, features a fully furnished interior and cost builder Michael Sheppard, of Sandown I.O.W., some 1,000 hours work. ▶

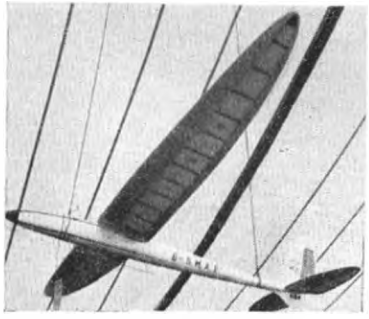
◀ *Free-flight Vickers Gunbus, by Noel Barker of Surbiton, has full pendulum controls. One of the nine cylinders of the Monosoupape motor, belongs to the Mills 1.3 which provides the power.*



Unusual choice of prototype, is this Everett Edgcumbe Grasshopper monoplane, by C. G. Crawley of Mill Hill, built to a scale of 1/48th. ▶

◀ *Cesare Milani's twin Merco 35 powered C/L Caproni 34, employs authentic construction throughout, while the cockpit and gun detail are especially noteworthy.*





◀ *Without doubt the largest model on show, will be this 18 ft. wingspan glider designed by A. D. C. Pollard, of Thames Ditton. Mr. Pollard completed 80 per cent. of the construction, the remaining work being by his pupils at the Queen Elizabeth Training College for the Disabled at Leatherhead.*

Roger Dudley built this interesting helicopter Jumpin' Bean. Rotor diameter is 27½ in., and power is supplied by a 0.8 c.c. Merlin, which is totally enclosed. ▶

The photographs of the "Vimy," "Gunbus" and 18 ft. Glider, were taken at a recent highly successful exhibition, staged by Vickers Armstrong, to celebrate their 50 years' association with Brooklands. In addition to those shown, many fine models, built by members of the V.A. Group Club, were on display.

THE second and final selections for the teams to represent Great Britain in the World F/F Championships at Leutkirch, Germany, were made at Barkston Heath on July 15th/16th. Following the first eliminators, which were flown some weeks previously in treacherous conditions, the lists were, to say the least, topsy-turvy, with many of our regular top men in two-figure positions.

The first day of the second trials was little better, but at the end of it, positions were drastically altered. John O'Donnell was top in rubber, followed by Norman Elliot and Dave Nelson. George French returned two more max's to maintain his perfect score in power, Ray Monks crept from third to second place and Dave Posner rocketed from fourteenth to third position!

This day's flying also produced three new top men in glider, Burrows, Salter and Dallimer, in that order and separated by a mere 13 sec.! Only 4 sec. behind Dallimer, and rapidly closing his lead, came Monks, previously in sixth place. Much confusion was caused by incorrect weighing during the first round—and many modellers were compelled to add weight until it was discovered that the processing was at fault! All were given the option of a second attempt at correct weight, but if taken the second flight would stand. Of those who took a chance some came off well—others didn't!

When we arrived at the field for the second and final day, the conditions were just about perfect—calm, dry and warm. During the first glider round Dallimer's consistent performance paid off and he climbed into top spot, closely followed by Freeston, up from fifth, with Monks now third man. O'Donnell's model came off his steel line prematurely, returning only 33 sec. and destroying his chances.

Two max's kept top places the same in rubber and Roberts replaced Nelson in third place. Dave Posner's brief excursion to the top terminated almost as spectacularly as it came about, when in one round, after changing models, he slumped to ninth place and A. Young leapt up from eighth to become the new No. 3.

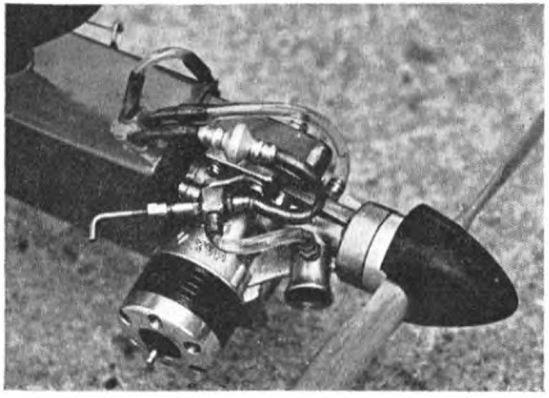
By the third and final round, George French, with the only perfect score, was so far ahead that he was able to do without his flight—and still retain first spot. Following an over-run, Monks' second attempt made only 1 min. 47 sec., which meant that if Young could get a max., Monks would be out. After launching crosswind and crashing dangerously near control, Young flew his reserve, and following an *exact* 10 sec. engine run, did, in fact, do the magic 3 min. Ken Glynn's third place, 5 sec. below Young, and 6 sec. ahead of Monks is, as we go to press, in dispute, the model specification being suspect and the subject of a close check, by S.M.A.E. Tech. Sec. Sam Messom.

Rubber was just as exciting. With Norman Elliot and John O'Donnell fighting for the lead and Roberts lying third, 1 min. 15 sec. ahead of Monks. Elliot's last flight was 2.46, while Roberts' 1.46 almost lost him third place to Monks, who flew a max to bring him only 1 sec. behind, into fourth place! John O'Donnell returned from a fruitless downwind search for his glider, just 10 min. before the end of the round and although his second team position was secure, he insisted on flying. Unfortunately with 2¼ min. to go, his motor broke and Sid Smeed announced the end of the last round just before he was able to launch. The flight was disallowed but O'Donnell has challenged this decision and tabled an official objection!

Not to be outdone, the final glider round proved to be equally breathtaking in the by now quite dull and gusty conditions. Dallimer's luck held and he had no difficulty in finding lift which made his leading position secure. Bruce Halford's max ensured his place in the team and once more unlucky Ray Monks only needed a max to oust Freeston who was 2.57 ahead, following a 1.56 o.o.s. flight in high wind. But Ray's luck was just not in and, with little lift around, he was only able to pull out 1.45.

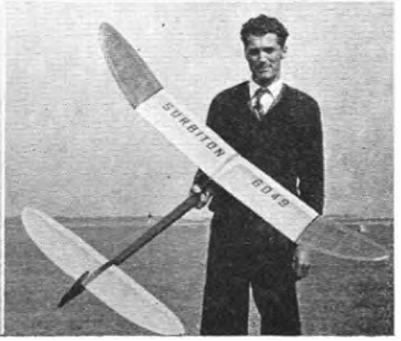
This was one of the most exciting trials we can recall, the teams being undecided right up to the very last minutes and with surprises galore. We are certain that all three teams will acquit themselves well at Leutkirch and we will present a fully illustrated report of what promises to be one of the biggest Internationals of all time, in our November issue.

In our heading photo unlucky Ray Monks looks a mite unhappy, but as we close for press we are informed that Glynn's model is definitely outside the specification, which brings Monks' into the Power Team.



Right: the somewhat complicated plumbing on French's pressure fed O.S.

THE TEAMS



RUBBER

Left: Elliott of Croydon, top in rubber, is assisted by Al Wisher as he disengages the winder prior to making his final flight.

Centre: S.M.A.E. Treasurer Harry Barker behind the scales, wears a somewhat sceptical expression as John O'Donnell selects a motor for his controversial last round flight. "Sorry sir, only 9 lb. of bagwash allowed!"

Right: Number three man Lou Roberts, anxiously watches a fellow contestants' model going rapidly o.o.s. during the breezy final.

GLIDER

Left: Dallimer's consistent performance gained him his well earned top spot in the glider team.

Centre: Up and coming Barry Halford, our second team member, dons a justifiably happy smile for our camera after retrieving his model at the end of the trials.

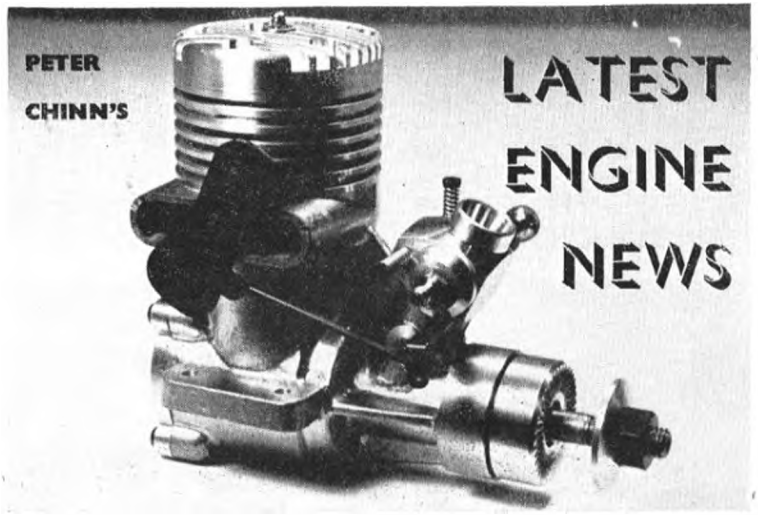
Right: After a hectic trials producing flying conditions to suit all tastes, Freeston ended up in third place, 33 sec. behind Halford.

POWER

Left: Cover boy George French, using his latest O.S. Max 15, romped into top position without even having to make his last round flight.

Centre: Tony Young of St. Albans, crashed his 1960 Champs' model in a tense final round and is seen here preparing his reserve which gained him second place.

Right: Glynn of Surbiton, whose third place was, we understand, subsequently disallowed as the model was outside the formula.



GREAT news for British multi-channel R/C enthusiasts is that the eagerly awaited Merco 49 (8 c.c.) has been tested in prototype form and shows every promise of being a first-rate power unit for the most advanced types of multi-channel models.

The production of Merco engines has now been taken over by D. J. Allen Engineering Ltd., makers of Allen-Mercury motors, but bringing the 49 successfully from the drawing board stage to the actual running of the first three prototypes was the final achievement of the late Model Engine Research Co. Ltd., and that enthusiastic and hard working pair, Bill Morley and Ron Checksfield. The design and construction of the 49 was primarily the responsibility of Ron Checksfield, but both Bill Morley and Dennis Allen had a hand in the construction of the prototypes as well as in the finalising of the design. Dennis, for example, supplied the crankshafts, cylinder liners and jackets turned to the first operational stage and Bill did the grinding on the shafts and cylinders. All three engines were started up for the first time on June 29th and two days afterwards, we were fortunate enough to obtain one of these on loan for the description that follows. A week later, Frank Van den Bergh set the seal of an R/C expert's approval on the engine when he air-tested one of the prototypes to compare it with the Super-Tigre .51 and .56 engines he has been using recently. (Photo: Radio Topics.)

The Merco 49 is, of course, a loop-scavenged, shaft-valve glowplug engine, like the well-known Merco Multi-speed 35, but is otherwise an entirely new design. The 35 was intended, originally, as a stunt C/L motor and the conversion to a throttle-equipped R/C edition was a secondary development—albeit a very successful one. The 49, on the other hand, was designed from the outset as an R/C engine. Advantage has been taken of the fact that larger overall dimensions and some extra weight can be tolerated in an R/C engine in the interests of durability and smoothness while extracting high power. The 49 is, as our American friends would say, a real man-size hunk of engine—practically as big as the Enya 60 and in prototype sandcast form, weighing some 13 oz. This weight figure will probably be reduced slightly in the diecast production version, although, in fact, two or three extra ounces in the right places are well spent in an R/C motor.

Major differences between the design and construction of the Merco 49 and the 35/29 models are in the bearings (twin ball journals instead of a phosphor bronze bush), piston (aluminium, with two compression rings instead of lapped Meehanite cast-iron) and cylinder (separate finned cooling jacket instead of a one-piece casting integral with crankcase).

The crankshaft has a $\frac{1}{2}$ in. dia. main journal (the largest that could be used with available suitable ball-bearings) and an 8 mm. front journal. Beyond the front race and prop driver, the shaft is stepped down again to a standard $\frac{1}{4}$ in. dia. for prop mounting. The shaft has a $\frac{1}{4}$ in. dia. solid crankpin and a substantial web that is cut away either side of the crankpin for counterbalance. A rectangular valve port, $\frac{1}{8}$ in. long, is used and provides a standard 45 deg. ABDC—45 deg. ATDC induction timing. The induction passage through the shaft is $\frac{3}{8}$ in. dia.

The piston on the prototype is entirely machined from aluminium alloy. It has a straight baffle, filleted at the root and a fully-floating 7/32 in. dia. gudgeon-pin with alloy end pads. The rings, specially made by a well-known piston and ring manufacturer, are 3/64 in. deep. A machined alloy connecting rods with plain, unbushed eyes, couples the piston to the shaft. The cylinder liner is moderately ported and the exhaust and transfer are each divided into four ports in the usual manner with ring equipped engines. The cylinder head has a hemispherical interior contour with a slot to accommodate the piston baffle. The glowplug is central. The head has six Phillips screws, three of them extra long to pass through the fins and into the main casting to secure the complete cylinder assembly. As on the 29/35, the cylinder is of the Desaxé type, offset to the exhaust side in relation to the crankshaft axis.

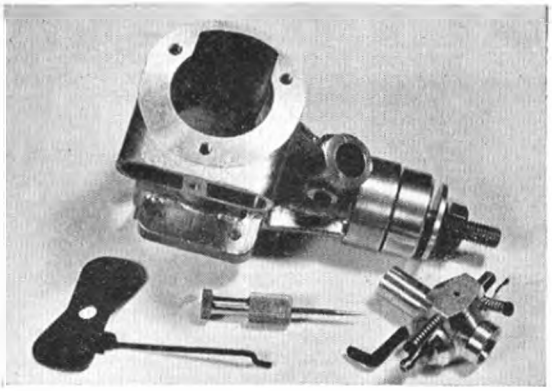
The carburettor and throttle assembly is the same as that used on the Multi-speed 35, incorporating a barrel throttle surrounding the spraybar and adjustable idling and air-bleed controls. A blade type exhaust throttle is used, but whereas the 35 exhaust blade is pivoted at one end, the 49 version is pivoted in the centre.

The whole engine is, needless to say, beautifully made and it is also a particularly "good looking" motor.

Enthusiastic about the Merco 49 was John Maloney, the American distributor for Merco in North and South America, who was recently in London on a flying

Heading photo shows the latest engine for multi-channel radio-controlled models, the fine Merco 49. Example shown is one of three prototypes just completed and now undergoing tests. Production versions are expected in two or three months.

Left: Jarry Burk, a member of the Model Engine Collectors Association, with part of his collection of vintage American spark ignition engines.



Above : sandcast crankcase of the prototype Merco 49. The throttle assembly is the proven Merco 35 type.
Top right: shaft and piston assembly of the Merco 49. Engine features a ringed aluminium piston and twin ball-bearing crankshaft.
Right: cylinder components of the Merco 49. Unlike the 35, the 49 uses a separate finned alloy cooling jacket.

visit en route for the Continent with his wife Helen. We had several hours with John, discussing engines and all matters modelling before leaving him at London Airport for his departure to Norway and Italy to visit engine manufacturers Jan David Andersen and Jaures (Super-Tigre) Garofali. John, who is a keen "multi" flyer himself, opined that, notwithstanding the availability of still lighter and more compact multi-channel radio, the trend of model design would, for the present, demand the continuing use of engines of 0.45 cu. in. and larger.

* * *

Another large engine that we have been testing lately is the Fox 40, a photo of which appeared in last month's "Latest Engine News." One is rather apt to be misled by the appearance of this motor. Externally, it looks like a somewhat hurried conversion of the Fox Rocket 35. It is, in fact, based on Rocket 35 castings and to obtain the extra cylinder capacity to bring it up to 0.40 cu. in., Fox have increased the stroke from 0.700 in. to 0.790 in. and simply popped the head on top of a lengthened liner. With a ¼ in. gap between the top of the cylinder casting and the head, this looks almost crude, but the handling and performance of the .40 was anything but. A lot of subtle development has gone into the inside of the 40—opened up intake porting, improved transfer porting, a lighter piston and heavier counterbalancing. Many of these modifications undoubtedly stem from the makers' remarkable success with the highly developed needle-bearing Fox Combat-Special.

We found the 40 very easy to handle and despite 6¼ c.c. for a weight of only just over 7¼ oz., it proved to be a quite smooth running engine of remarkably good performance. Using a mild, low nitro content fuel, it proved capable of turning a 12 × 4 prop at nearly 10,000 r.p.m.; bettering 12,000 on a Tornado 10 × 6 and it takes a very good .35 to reach this latter figure on the most potent fuels.

The 40 was evolved primarily to make full use of the American "rat-racing" rules but it should also make a good stunt motor, particularly for those who need a little more pep to cope with an overweight model.

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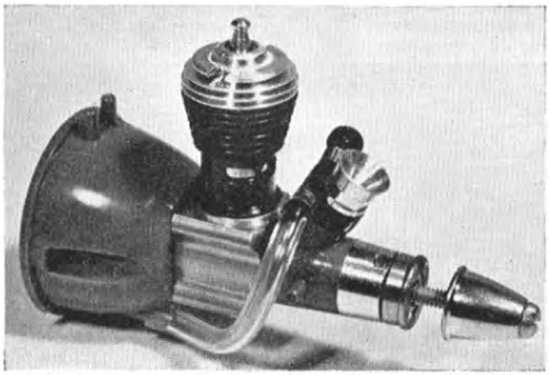


Left: the new Cox Tee-Dee .020. Design is similar to the .010 model featured in M.A. Engine Tests, July issue. More power than the reed-valve Pee-Wee 020.

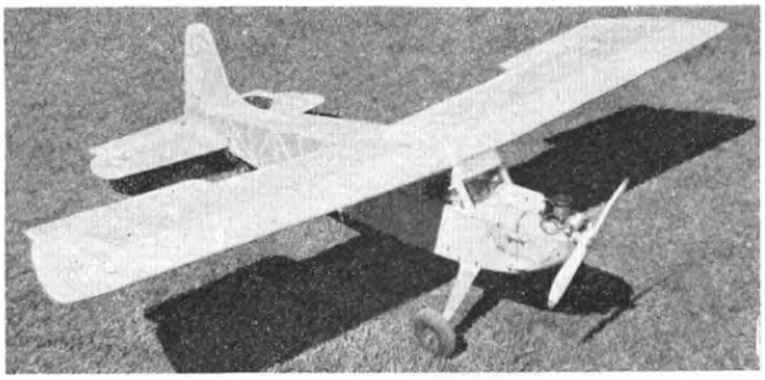
Jerry Burk of Arlington, Texas, U.S.A., whose picture we show on page 274, has a collection of some 70 different types of American spark-ignition engines, dating from the mid-thirties to 1950. Burk, who is a design engineer with the Chance-Vought aircraft concern, is a member of the Model Engine Collectors' Association, whose activities have been mentioned earlier in these columns. Recognisable in the photo are many famous engines of the 'thirties and 'forties as well as some lesser-knowns, among them: Brown Jr., Baby Cylone, Super-Cyclone, OK Twin, Forster 99, Elf Four, Contestor D.60, Atom, Dennymite, Atwood-Champion, Rocket 45, OK 60, Fox 59, Synchro Ace, Thor, G.H.Q., Brownie, Arden 099 and Hornet.

* * *

Some of the most delightful letters we get from overseas come from Japan: their modest terms, whether from modellers or manufacturers, often make a refreshing change! Note this extract for example: "I am very much interested in small diameter of Eta 15 crankshaft. We have heard of excellent steel, fine design, precise workmanship of English made machines for a long time. Before the second war, Kawasaki and Mitsubishi (leading aircraft makers in Japan) thought to build Rolls-Royce Merlin engine. But they dared not produce it because it was designed too delicately and made of too high quality materials and so Kawasaki began to produce German Daimler-Benz 601 engine instead. ¼ in. diameter crankshaft for .15 diesel is R.R. Merlin class design for us!"

The interesting bit is that this came from a friend of Mr. Honda, the man whose astonishing 125 and 250 c.c. motor cycles, their engines sounding like a brace of Holland Hornets, swept the board 1-2-3-4-5 in this year's T.T.

HARRY STILLINGS describes his . . . .



MULTI SUPER-60

I HAVE been following, with interest, the account of the MODEL AIRCRAFT editorial staff's first really active "intrusion" into the field of radio control, and was especially interested in the general design and description of the Keilkraft *Super* 60. This is a very nice-looking model with semi-scalish lines and the thought occurred to me that this might be just what I had been looking for.

As some readers will know, I have been flying R/C for some years now and graduated to multi about three years ago. I have described various "poor-man's-multi" types of set-ups in previous articles, using single or three channel equipment, but for the last two seasons have been using the R.E.P. "Sextone" transmitter and receiver. This was first used with an own-design cabin monoplane, using two channels each for rudder, elevator, and engine control. The model in question, however, was excessively loaded and after the wings had twice parted in mid-air, through sheer G-force during stunts (the Sextone receiver miraculously surviving both disasters), I prudently decided the time had come to build another model.

My choice was the well tried and popular *Smog Hog*, again using the same control set-up. This is an excellent multi trainer and I had many hours of relatively carefree flying with it. I then decided to have a go with one of the then favoured fully aerobatic jobs and, with the very limited choice available at that time, selected Chris Olsen's *Uproar*. With my penchant for getting the utmost value for least expense, I managed to achieve most of the advantages of eight-channel equipment from my relatively inexpensive Sextone outfit, by using two channels for elevator, two for ailerons, and one each for engine and rudder.

Using the original Remtrol-Olsen servos for elevator and ailerons effected a further economy and the only "extras" I had to obtain were a Fred Rising compound actuator, rubber driven, for selective rudder control (costing 49s. 11d.) and an F.R. lightweight sequence actuator (at 25s. 3d.) to give high and low engine speeds on the two neutrals.

Probably due to my own building faults, coupled with a sick motor (after struggling for several weeks I discovered that this was due to a pin-hole in the fuel feed!), I never really achieved much success with *Uproar*. In any case, I found that this type of contest design did not meet my particular wishes, which were more particularly directed towards realistic flight, i.e. more on the lines of a light club aircraft, with manoeuvres which could be actually *watched*, rather than the "contest" sort which are missed, if one happens to blink at the psychological moment!

I am fully in accord with the comments in "Radio Topics" (M.A., May, 1961), namely, that the modern multi contest model is far too fast and resembles a guided missile, rather than a miniature aircraft. Being rather old in the tooth myself, I suppose it is inevitable that my ideas about aerobatics are on the lines of the old romantic "flying circus" displays, when intrepid aviators used to make Avros and *Tiger Moths* do almost everything but sit up and beg, at what appeared to be an impossibly slow flying speed. Anyway, rightly or wrongly, I decided something like this was what I wanted, but the problem was "What to build?"

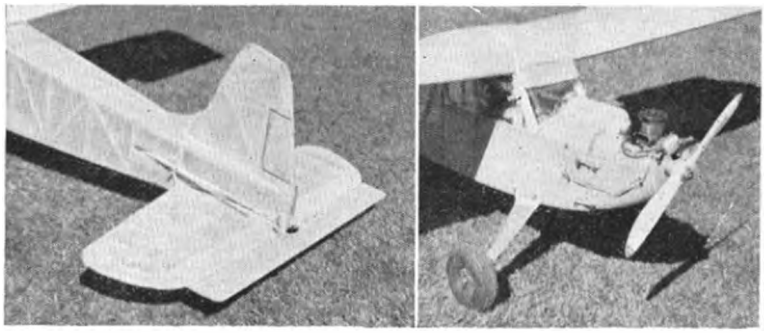
It was then that the new Keilkraft *Super* 60 made its bow and the M.A. staff recounted their entry into R/C via this model. The penny did not drop immediately, but a nebulous idea started to grow in my mind that this good-looking, nice-size, model might, with suitable modifications, be the answer.

I therefore duly purchased a kit and installed my "eight-for-the-price-of-six" equipment. To avoid encroaching too much on the minimal lifting area of the 10 in. chord wings, the ailerons (made from ¼ in. sheet with lightening holes) were set only partially inboard. The centre section had to be slightly built up to accommodate the Remtrol-Olsen servo. This, if anything, rather improves the scalish appearance of the model. In addition, the dihedral was reduced from 4 in. under each tip to 2 in.

The elevator was constructed in one piece of mm. ply, bonded to 3/32 in. sheet, attached to the trailing edge of the T/P with the usual tape hinges. A semi-circular hole is cut in the elevator to allow the passage of the retaining bands and the single central dowel at the rear of the fuselage is replaced by a transverse dowel, to allow the fitting of a crank through the stern post for rudder control. Apart from these necessary modifications, the construction is exactly as per plan and, speaking for myself, I found the kit contents to be of very high quality, all pre-cut pieces a perfect fit, and the building instructions very comprehensive and easy to follow. Also, the dural-cum-10 g.-piano-wire undercarriage and the plastic bottle "clunk" tank are unusual and very welcome luxuries! Actually, I use a 6 oz. bottle, as the small 2 oz. version supplied isn't big enough for thirsty motors.

I fitted a Merco .35 and experienced vibration troubles, which I had anticipated, as the engine mount is paxoline sheet on hardwood bearers and all vibration therefore has to be absorbed back through the fuselage. I have had this trouble before and worked out a

Continued on page 289



ROVING REPORT

Typical Sunday R/C gathering in Victoria, Australia. Picture from Norman Ball of North Balwyn. The three American "Pegasus" mid-wing designs all have 10-channel equipment.

MILAN DRAZEK, leading Czechoslovakian team racing expert, has sent us details of his latest team racer. This model, named *Charleston*, uses the new 1961 MVVS team racing diesel of 2.491 c.c. The engine turns a 180 × 190 mm. prop (7.1 in. × 7.5 in.) at 14,200 r.p.m. and the level flight speed of the model is quoted as a very healthy 97 m.p.h.

The model, the design of which Drazek admits was inspired by Neri Bernard's famous *Star-Tiger*, has a span of 38.6 in. and is 28 in. long. Wing and tail surfaces have an elliptical planform, and a monowheel undercarriage is used.

* * *

It looks very much as though, under good conditions, maximums in F.A.I. F/F will be coming just as thick and fast as ever, despite the new 10-sec. motor run rule. For this, we can thank (?) Messrs. Cox, O.S., K & B and Super-Tigre who have suddenly raised 2.5 c.c. engine performance by something approaching 50 per cent. George French, top man in the British team to the forthcoming World Championships, scored nine maximums out of a possible 10 in the two rounds of the team selection trials, using an O.S. Max Racing 15.

In the U.S., we hear of successive maximums being scored with K & B Torpedo 15R and Cox Tee-Dee powered models. John Brodbeck of K & B tells us that Larry Conover reports an output of 0.54 b.h.p. from his Torpedo 15R *on an* 8 × 3½ *F/F prop* !

* * *

After a long interval, we have just had a letter from Monty Tyrrel who, some readers may recall, was over here in 1953 with Don McLaren and Derry Brown as an unofficial Australian team. Monty tells us that Don McLaren is now out of modelling and has become a professional water-ski instructor and aquatic circus performer. Monty himself also had a non-modelling period lasting a couple of years and was only persuaded back into the fold when Bill Morley sent him a Merco late in 1959. He was rejoined by Derry Brown about the same time and, since then, they have both been doing big things with Merco powered stunt models in Australia—for one very good reason: Tyrrel, for the past year, has been Australia's distributor for Merco engines.

At first, Monty tells us, Australian reaction to the Merco was apathetic, it being thought that we in Britain could not make a stunt motor that would match the leading American and Japanese 29s and 35s available in Australia. "Now," says Tyrrel, ". . . the recent successes of the Merco are showing the Australian modeller that Britain can make a 29-35 motor that is equal to the very best, which means that it is better than most."

Top right: a long way from home, well-known Australian modeller and O.S. importer Tony Farnan in Cincinnati, U.S.A., with fellow importer John Maloney's new mid-wing multi-channel R/C model. Note Tony's hand hiding engine (a Super-Tigre!).

Right: last season's leading Polish stunt flyer was L. Nowakowski from Siedke, seen here at the Polish Nationals with his 5 c.c. Sokol diesel powered model.

Left: Czech team race expert, Milan Drazek and his 97 m.p.h. "Charleston" team racer, powered by the new Czec hMVVS 1961 TR-2.49 motor.

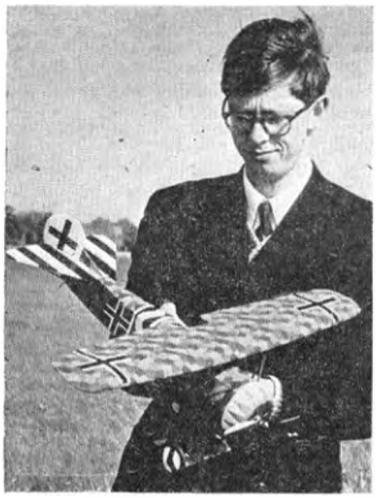
This year, particularly in Victoria, Merco powered models have scored some major successes. In the hands of Monty Tyrrel and Ken Taylor, Merco powered stunt models took 1st and 3rd in the Western Districts Senior Stunt event. More success came when four Merco powered models placed in the first six in the State Championships. Winner was 1961 National Stunt Champion and former Junior Champion Doug Harlow, who flew a large semi-scale Piper *Comanche* which also won top appearance points. Tyrrel and Brown, incidentally, are using enlarged Veco Chiefs—no less than 700 sq. in. wing area and 3½ lb. weight.

* * *

With everyone wondering what sort of speeds the Czechs and Hungarians are going to pull out of the bag under the new straight fuel rule, we have just heard the results of the first major Czech speed contest of 1961 held at Jihlava—and confess to having breathed a sigh of relief. The old master, Josef Sladky, won the 2.5 c.c. class with 175 km./hr. (108.74 m.p.h.). Machacek was second at 170 km./hr. and Burda was third at 167 km./hr. Of course, they *might* have been holding something back and foxing us all, we suppose. . . .

M.F.Hawkins'

FOKKER D.8.



The lively and extremely tough little free-flight scale job that attracted so much attention at the Nats.

THIS year I had one month in which to build a model for the Super Scale Trophy at the Nationals, so a simple, flyable, subject with a bright colour scheme was called for. Here is my answer.

Although usually known as the DVIII (D for "Doppledekker"), this plane is correctly titled the E.V. (E for "Eindekker"). It is one of the few aircraft that appears to have been designed with the scale modeller in mind—we should be grateful to Reinhold Platz.

Construction

Wings. Ribs are made by the sandwich system. The spars are pinned down onto the plan, with the dihedral braces, which are placed under rib 9. This will give the correct washout at each tip.

The wing fixing consists of rubber bands, which pass through a ¼ in. dia. paper tube inside the centre section. The bands are fixed over the wing rests, using the hook shown on the plan to thread them through the tube.

Cover the wing with lightweight Modelspan, give two quick coats of dope, then pin down for 48 hours. This will prevent warps.

Tail. Pin down after covering and doping as with the wing. Aluminium hinges should be stiff so that trim will not be accidentally upset.

Fuselage. All the wire struts should be tinned where necessary, the wing struts should then be threaded through the fuselage frame and the undercarriage bound on with fuse wire and soldered. The struts are then bound to the frame with thread and well cemented.

The 1/32 in. sheet fuselage sides are cut slightly oversize and slit, so as to slip over the wing struts. The wing rests can now be soldered on to the struts and should be lined up to have a slight positive angle of incidence, with the fuselage top. Strut fairings are attached with Evo-Stik.

The engine mount is cut to suit the motor, well braced to the front former and the tank cemented beside it. The cowling is laminated on its jig, trimmed to size and attached with Evo-Stik.

The stub wing is built onto the axle, after this has been soldered to the undercarriage struts.

Decor. One aircraft was flown in the U.S.A. after the war. It appears to have been a glossy dark green overall, with no markings except red, white and blue strips on the rudder, blue foremost.

Lozenges do not take as long to paint as one might think, if a celluloid stencil is cut for the first colour, the lozenges marked out with a soft crayon and painted in, then another stencil is made for the next colour and so on. The fourth colour can be added by eye and the fifth fills up the remaining spaces. Using one coat of matt Humbrol enamel it took me three evenings to do the lot.

Unit markings are well shown in Imperial War Museum photograph Q 66496, but there was even a DVIII with Japanese red runs, with a narrow white outline in place of crosses. The rudder of this machine was plain white and it was marked DVIII below the cockpit.

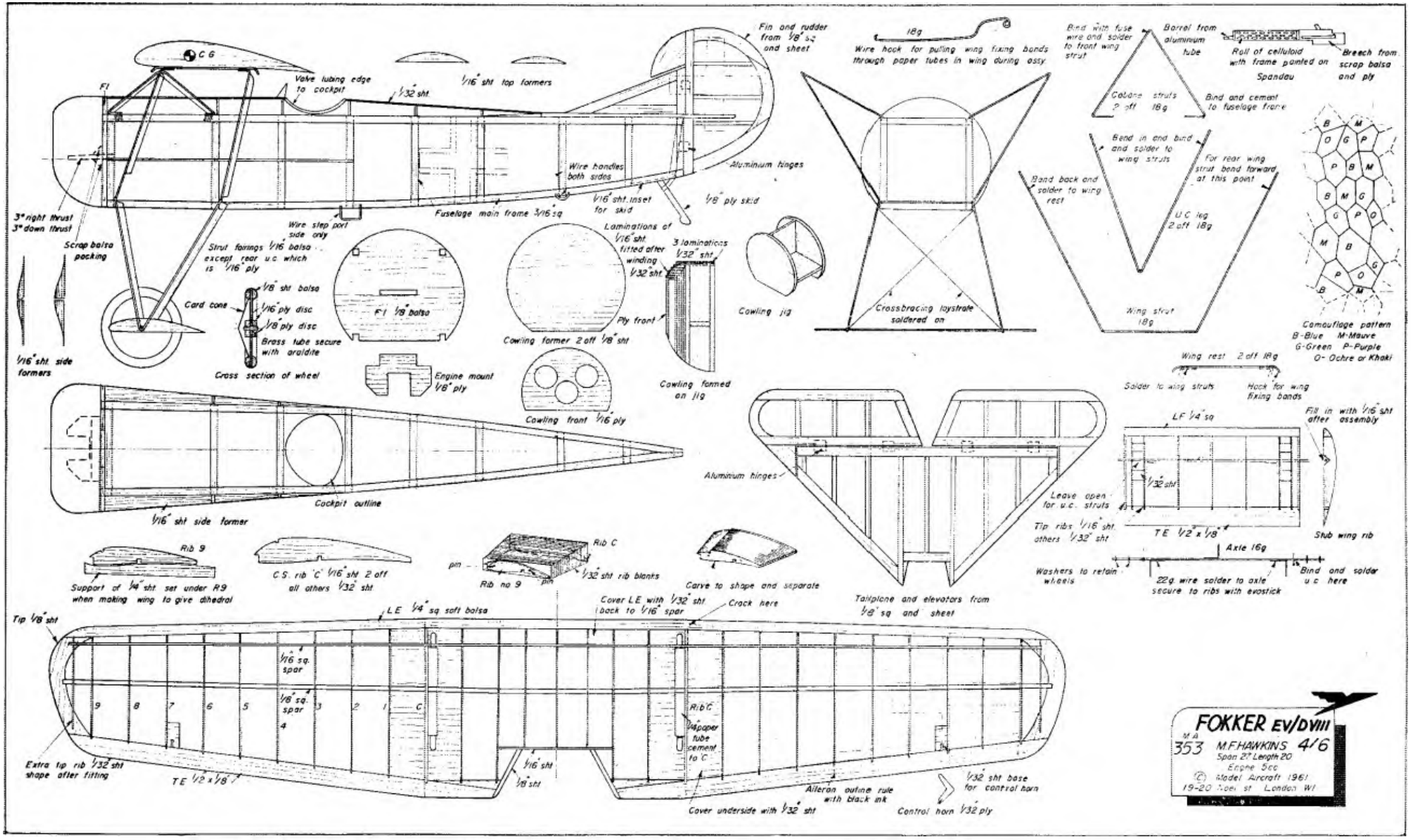
Trimming and flying

I used a D.C. Dart, with a D.C. 8 × 4 in. nylon prop. A little lead was added over the motor, to bring the C.G. into the position shown, which brought the all-up weight to 8¼ oz.

Hand glides do not give a very good indication of trim, so give slight right rudder and launch over long grass on low power. The model should fly fairly straight. On full power it will then give a rapid climb in a left spiral and a glide to the right.

It seems to be a very stable model and will fly when quite badly out of trim, it is also practically crashproof. I bounced it off the tarmac at the Nationals, without doing any harm at all.

R.O.G.s are most impressive with no tendency to ground loop.



FULL SIZE WORKING DRAWINGS ARE OBTAINABLE FROM YOUR LOCAL DEALER, OR BY POST FROM THE "MODEL AIRCRAFT" PLANS DEPARTMENT, 19-20, NOEL STREET, LONDON, W.1, PRICE 4s. 6d., POST FREE

TOPICAL TWISTS

by PYLONIUS

Little Wonder

Ever since the heavy gang manhandled the first engine into a model plane, and then proceeded to knock down the kitchen wall to get the model out, it has been the endeavour of every manufacturer to whittle down the bulk ironmongery to portable dimensions; to produce a unit that would not only suit every pocket, but fit it, too. Apart from its usefulness in powering the occasional small model, the manufacturer could perhaps foresee the pocket sized engine fulfilling its main role as a playground swapping item.

The first objective, that of making an engine that would fit snugly into a school satchel without seriously impeding the pet hamster's exercise or knocking Oliver Cromwell about a bit, was quickly achieved, and it was not long before the vest pocket sized unit made a cosy fit between the broken bladed penknife and the half-eaten gobstopper. What is more, any egg-headed schoolboy, who had time to experiment between exams, would find the mechanical gadget capable of flying a model plane.

By now the miniature engine had reached perfection as a piece of model flying mechanism. It could whisk a large model from one end of an airfield to the other, with power to spare, and could circulate on the end of a pair of wires at a speed which only the most athletic handle waver could match. No reasonable person could ask for more. At this point the thrill a minute boys began to abandon model flying for the model boat and race car, and altogether the miniature engine was losing its novelty appeal. So much so that antiquated gliders and rubber models were once again to be seen on our flying fields.

It was about this time that the cult of engine worship suddenly sprang into being. To satisfy the strange lusts of the afflicted, engines had either to be too powerful to be practical, or too microscopic to handle. Now, at last, in one direction we can hope that the ultimate has arrived with the latest product of Pippin Power Units Ltd. Their new 0.0000001 engine is so small that it can rest on a pinhead. When asked what pinheads had to do with model engines, Mr. Glowlightly, the Managing Director, referred to his growing clientele. He was also proud to point out the exceptional, and indeed exclusive, appeal of the new Pippin to collectors, in that it was so minute that it was impossible to build a model small enough to take it.

Mr. Glowlightly went on to stress that too often the manufacturer's masterpieces are treated in a shamefully frivolous manner—even being used for the powering of toy planes. Only in the seclusion of the tool shed can the exquisite harmonies of the B.H.P., and Torque Curve be truly appreciated, while the real connoisseur prefers the abstract approach of pure, non-mechanical contemplation.

Mr. Glowlightly was proud to point out that, while other manufacturers had been partially successful in frightening off the model flyer with engines of such ear splitting ferocity that they would inevitably be banned from every flying field in the country, the Pippin 0.0000001 was the first completely non-flyable engine to come on the market.

Stop Me and Fly One

When next you make that telephone order for a couple of strips of ¼th square, it might well be a waste of time tearing off that extra strip, for the courteous gentleman taking your order will most likely be just a mass of wires and valves, instead of the usual mass of nerves and outworn patience.

Usually, the modeller who places an order by phone has been thrown out of all the model shops in the district, and his idea of spending an enjoyable afternoon is a leisurely survey of the entire stock, from radio transmitters down to the veriest building pin, ending with the purchase of two sheets of tissue —if the proprietor is lucky.

By applying the same technique to his telephone order he has given many a model shop proprietor a swollen ear and a deflated bank balance. To this sort of thing the robot telephone is the perfect answer, and should cut down the social chit-chat to a point where the model establishment can get its order out of chaos.

With automation gaining way in the model world the day is not far off when models will be operated from the ground electronically. Already we have radio control, which sometimes comes very near to this, but we can now look confidently forward to the day when the fully automated model becomes available from the dispensing machine on the flying field. You will merely have to insert ten shillingsworth or more of coppers, press the appropriate button, and out will pop your flying requirements for the day.

You can further take comfort from the thought that all that tedious trimming will be a thing of the past—the model of the future will have its flight schedule programmed on to tape. At the end of the day the models, which will be made of disposable fabrics, can be put in the special litter bins provided, thus obviating the tiresome business of carting home the usual wreckage.

With all models enjoying a comparable state of perfection, there will be no silly old contests to spoil the day's flying. Nevertheless, prizes will be competed for, but in a more up-to-date and socially agreeable way. The dispensing machine will incorporate a fully automated Bingo system which operates on a sort of reverse sprinkler system—as soon as the rain starts.

Dig This Latest Craze

Now that the model plane is fast reaching its ultimate in development (any further advances will bring it into the guided missile range) some of our transatlantic friends are reacting by taking a header into the sands of the past. Pre-war kits and plans are now so much in demand that the more ancient model shops are at last disposing of their dust enshrined relics. Kits that have lain shelf-borne for over two decades of novelty chasing are being assembled with reverent care, while attic bound models of an earlier age are restored to their previous glory, like old masters.

Although few of the kit diggers have ventured back as far as the pre-balsa age, a few sticklers for punishment are clamouring for the return of the birch—not to mention the oiled silk and bamboo.

All this is jolly good fun, no doubt, and helps to take our minds off such frightful modern inventions as Speed and Combat Models. But, before we give too heartily with the ha-ha we might well take a closer look, at these pre-war relics. They might seem a bit fat in the fuzz and long in the undercart for our austere modern tastes, but they flew well enough to make us doubt whether a quarter of a century of progress consists of very much more than horse power and gadgetry.

Model Ads

Still on the subject of pre-war models, I've noticed of late quite a number of popular press adverts which feature a small, vintage rubber model as the centrepiece of the happy family group. The inference is that, the model (expertly constructed) was put together by the thoughtful six-year-old boy, with not a little help from his still younger sister. I forget what proprietary goods provided the domestic zest for this feat of infant virtuosity, but I did think the choice of wing covering a trifle odd.

Another, quite different, form of advertising was seen at a recent rally, where some politically minded modeller had fixed a "Join the ————" banner across his car. Just as if we didn't have troubles of our own!

We might have politely told him that he was wasting his time, for anything savouring of administrative work is anathema to any healthy-minded modeller. Indeed, our movement holds the only A.G.M., which could be comfortably accommodated in a phone box, and can pride itself upon having less officials per member than any other organisation. If you go to a Swimming Gala or Athletic Meeting, the competitors have to fight their way to the starting points through a thick sea of be-flannelled and be-crested officials, but at a model meeting "Do-it-yourself" administration is now the accepted thing. In fact, if anyone does set himself up as an official he is looked upon as a bit of a big head, and often becomes the subject of angry letters to the model press.

JOHN POOL discusses PITCH and PROPELLERS

for rubber models

Part 1

THESE notes were begun as a result of questions asked by many of my acquaintances, after "Designing for Duration" was published in MODEL AIRCRAFT (March 1958). Readers may remember that this article was mainly about an economical way to achieve a 4 min. model. The type of model suggested was a Wakefield size airframe, built light with a 50/50 airframe rubber ratio, an all up weight of between 5 and 5½ oz., and a slightly "stretched" motor run—about 1½ to 2 min. These models were using the "cruise" part of the power run, rather than the surge and the only way to do this, without diving before the fold, was to keep the gliding speed low, by using a very low wing loading. This article is an attempt to clear up the odd loose ends left in "Designing for Duration," and also present a further report on progress.

It would have been published earlier, but for a vain attempt last year to collect some really reliable still air data. Vain, because this type of model will benefit from the very slightest amount of lift. The still evening air, in which the old Wakefields used to do the magic 5 min., was sufficient to keep 50/50 models up almost indefinitely, until either the d/t or some obstruction interfered. At about the same time as "Designing for Duration" was published, there was a short article in MODEL AIRCRAFT about wash-out on propeller blades. This was confusing, as I realised when some friends examined my propeller and remarked that it had a lot of wash-out. In actual fact it had the normal twist of a helical pitch propeller, but neither wash-out nor wash-in, the pitch at every station along the blade being exactly the same. I still do not know what wash-out on a propeller blade meant, but I strongly suspect that it referred to the normal twist of the blade and, as such, was misleading.

In showing how to mark the hub end of a propeller carved from ½ in. sheet balsa, using a pitch triangle near the tip and a square at the root (Fig. 1), I omitted to show how the pitch triangle itself was marked out. I had assumed that most readers would be familiar with the standard pitch diagram, but subsequently realised this was not so.

To calculate the geometric pitch for any propeller, draw a right angle triangle to scale, as in Fig. 2, the vertical representing the pitch in inches. Mark the triangle on graph paper, using the small squares to represent inches, e.g., using graph paper divided into 1/10 in. squares, the vertical for a 30 in. pitch propeller would be 30 tenths, or 3 in. high.

A simple calculation is necessary to determine the horizontal line. To find the pitch angle at the tip of the same 30 in. pitch propeller, multiply the diameter by 3 1/7. The resulting figure is marked off on the horizontal scale again using one small square, or 1/10 in. for one unit. As an example, suppose the diameter is to be 24 in., 3 × 24 = 72 to which must be added 1/7 of 24 which is 3 3/7. The total (75 3/7) is now marked off on the horizontal scale and this allows the third side of the triangle to be completed. The angle formed between this side and the horizontal will be the tip angle of the propeller. A template cut to this angle will serve as a pitch triangle when marking the hub.

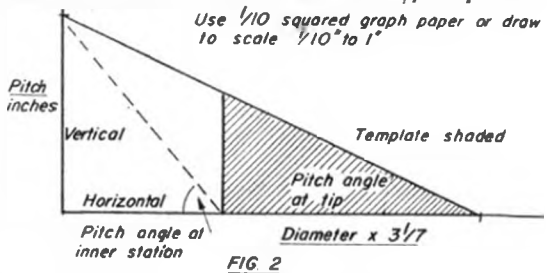


FIG 2

If the propeller is to have a constant pitch, the angle of the blade at different points along itself will differ. Some people have suggested using a higher pitch at the roots, but there is no evidence

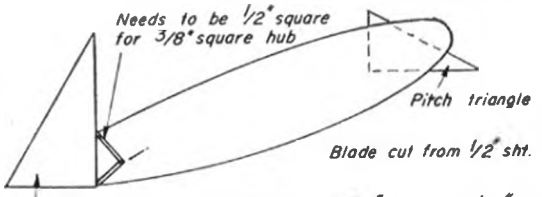


FIG 1

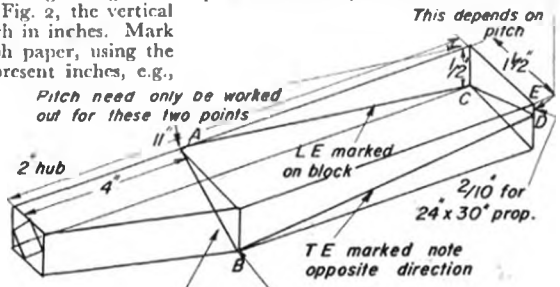


FIG. 3a

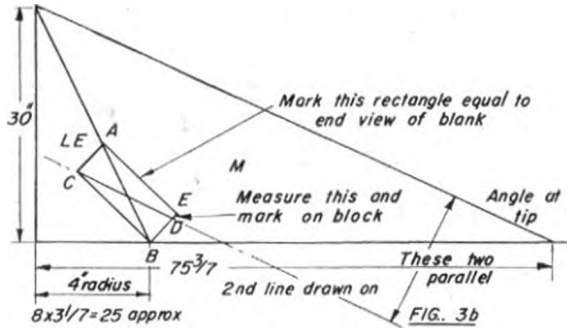


FIG. 3b

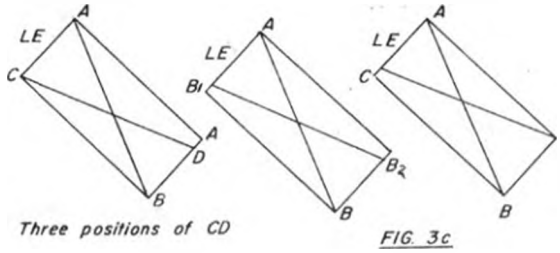


FIG. 3c

to prove that there is anything to be gained from this. In fact, the new Wakefield propellers are getting rid of the sectioned root altogether.

The pitch diagram can also be used to show the angle at different points along the blade. Thus to find the angle at 6 in., remember the diameter at this point will be 12 in., substitute the 12, multiply by 3 1/7 and mark off the units on the bottom scale. Now draw in the third side to the new point to find the required angle. This is very useful because if the propeller is to be carved from a straight sided block it is only necessary to calculate the pitch angle at two stations on the blade.

This again is best shown by example. The blank for the 24 × 30 in. propeller can easily be carved from $\frac{1}{4}$ in. sheet. The width of the blank must be decided and $1\frac{1}{8}$ in. is an economical minimum, but the principle works for any reasonable width. It is also advisable to decide on the point from which the blade shape will be blended into the hub and this transition should be as near to the hub as possible. Bearing in mind that the inner 3 in. of each blade are supposed to be inefficient, this is not a bad figure to chose, although I usually make the transition 4 in. from the centre.

The blank itself may then be laid out as shown in Fig. 3a. Cut the blanks to length—remember the length of each blade is not half the final diameter, it is half the final diameter *less* the hub itself. Mark the point from which tapering and blending is to be done. The twist is produced by marking on the edge of the blank a leading and trailing edge, sloping in opposite directions at the front and rear. The exact angles of the blade at AB and CD on the diagram must now be calculated before these can be marked.

The pitch diagram (Fig. 3b) must be superimposed on to the end shape of the blank. This is, of course, a simple rectangle, in this case $1\frac{1}{8} \times \frac{1}{4}$ in., and I cut this shape out of a piece of ply and draw round it. It must be placed on the diagram with its diagonal on one of the pitch lines. Either may be used, but I prefer to use the inner. Placing the rectangle in such a manner implies making another decision—that the full depth of the block will be used for the pitch at this inner point. It is then usual to draw the LE in from the top of the blank at this inner point, to the bottom of the blank at the tip and draw the trailing edge from the bottom of the blank at the inner point, to the top at the tip.

This is not certain to give the desired result and to ensure a really accurate pitch a little more marking out is needed. Another line must be marked across the end view of the block in the diagram, parallel to the line for pitch at the tips. Bearing in mind that this line is parallel, it can be marked in three positions (Fig. 3c). These again are shown diagrammatically. Whichever way is chosen, by measuring A, B, B_2 or C, it is possible to mark exactly at the end of the block, where the LE and TE lines must be drawn to.

The pitch of the propeller will be constant over the parallel part of the blade, and, because of the taper towards the root, approximately correct inboard. The taper may be arranged symmetrically, or concentrated on the leading or trailing edges. If straight hinges are to be used, then keeping the leading edge straight is worth considering.

Straight hinges mean that when a propeller is folded on a square fuselage, one blade will fold high up on the port side of the nose and the other blade, low down on the starboard side. By arranging to have most of the blade area behind the centre line of the hub, two snags may be avoided—having part of one blade above the profile of the fuselage, probably giving an undesirable fin effect, while the other blade dangles below the fuselage and bears the brunt of the landing.

The Bilgri type propellers, using a crossed blank (Fig. 4a), may also be worked out using the pitch diagram, but, because the leading and trailing edges come together at the centre of the propeller, only one pitch station, the tip, needs calculating.

The width *or* depth of the proposed block must be superimposed on the pitch diagram and the pitch line will then give the other dimension. It is almost impossible to reproduce the flared out front of a Bilgri propeller from $\frac{1}{2}$ in. sheet and a typical block could measure $3\frac{1}{2} \times 1\frac{1}{8} \times 11$ in. Balsa of such a size is not usually to be found in model shops, so the very old method of using strips of $\frac{1}{4}$ in. balsa, fanned out, is often resorted to. However, this type of propeller usually has its blades trimmed to 2 in. wide, so it can, in fact, be carved from the more readily obtainable 2 in. wide block, by a simple

Continued on page 301

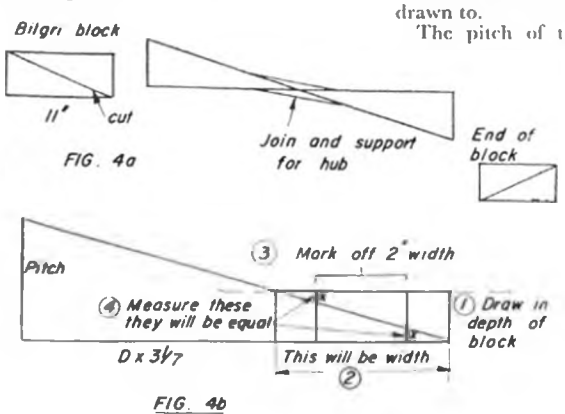


FIG. 4a FIG. 4b

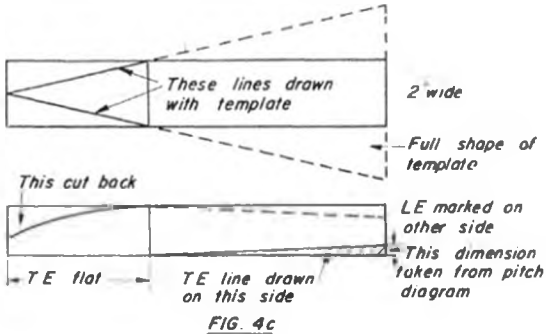


FIG. 4c

World Championship

INDOOR TEAM TRIALS

COMPETITORS at Cardington, flying for a place in the British team for the 1961 Indoor World Championships, were confined to a handful of flyers who considered they stood a chance and, perhaps because of this, produced some of the finest flying yet seen. Each competitor was allowed to make as many flights as he wished, the top three counting in the selection score. This system worked extremely well, as it removed the hazard of "hung up" models, which might well have introduced the luck element, if only three official flights had been allowed.

The times, as detailed in the results, show the fantastic improvement that has been made recently and amply reward the efforts of the S.M.A.E. in obtaining the use of Cardington and running the earlier practice meetings.

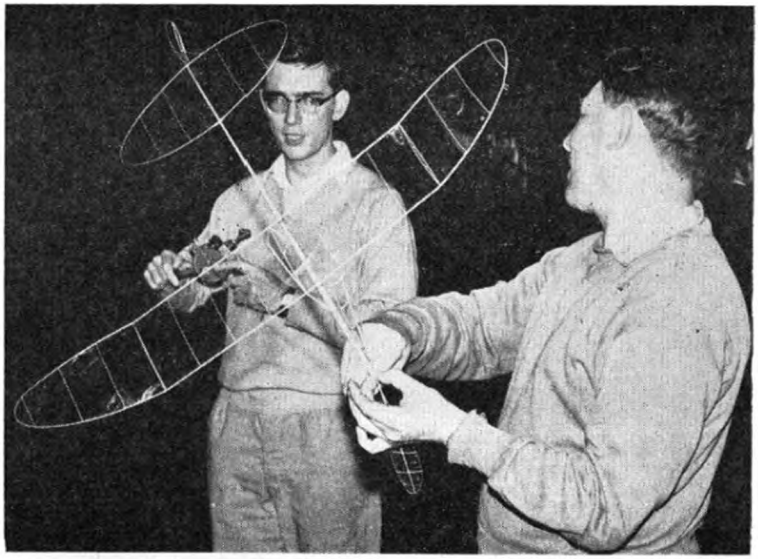
* * *

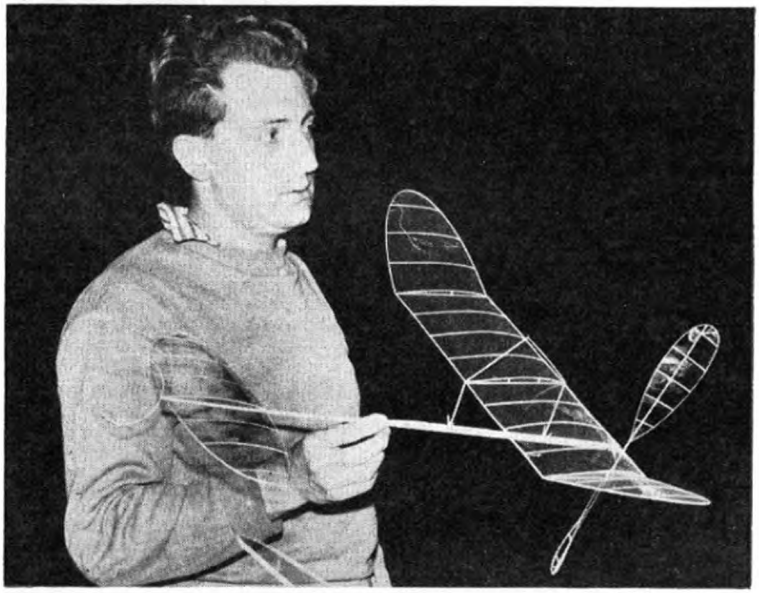
To date entries from four other countries have been received—Finland, Germany, Hungary and America. The first three have not yet selected their teams, but Joe Bilgri, William Bigge and Carl Redlin will be representing America, which gives a good idea of the quality of the opposition our own team will face.

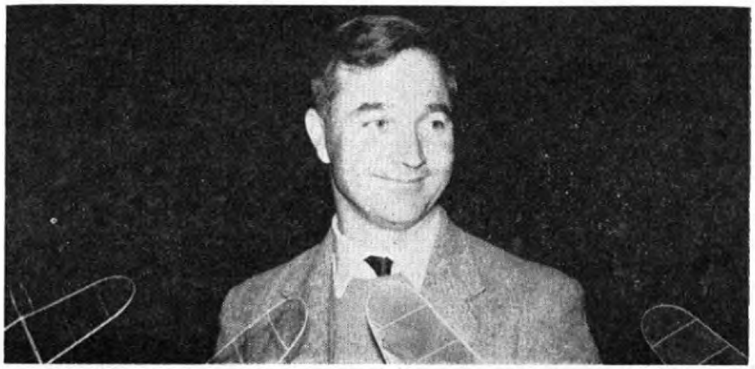
* * *

RESULTS

1. P. Read (Birmingham) 32.12, 31.06, 30.44—94.02 min.
2. R. Draper (Coventry) 31.47, 29.53, 27.00—88.40 ..
3. R. Parham (C/M) 29.08, 28.25, 28.15—85.48 ..
4. R. Monks (Birmingham) 28.47, 27.01, 25.42—81.30 ..
5. A. Barr (Coventry) 21.09, 20.41, 19.25—61.15 ..
6. S. Wade (C/M) 20.40, 20.30, 19.46—61.04 ..







Right: The team, from top to bottom: Phil Read winds assisted by Roy Monks (who seems to have been fourth in everything this year!), Ron Draper and Reg Parham.

RECENT RALLIES

At the N.H. Gala. Left: George Fletcher hand launches for Stewart Uwins to win the R/C event. Right: P. E. Norman with his Fox 15 ducted fan R/C entry.

Northern Heights Gala—*R.A.F. Halton*

FOR only the second time in some 15 years, the club picked an off day! After a week of perfect Northern Heights weather, the conditions were wet and somewhat miserable. However, from the strictly flying point of view, it was not too bad—only the combat being delayed (wet streamers) to any extent.

The radio event, with its simple rules—models must be airborne more than one and less than three minutes, then spot land—attracted a good crowd and showed some very good approach judgment. Stewart Uwins notched up his third win in as many contests with his *Jackdaw* and settled the complaints of a few disgruntled competitors, that Chris Olsen had an unfair advantage with his "full house" *Uproar*.

A complaint after the meeting, showed that F/F competitors *still* have not learnt to treat crops with suitable respect. Some worthy ploughed through a field of wet corn in search of a model, causing sufficient havoc to place in jeopardy the holding of future N.H. Galas at Halton. Will people *never* learn?

RESULTS

Queen Elizabeth Cup—1. M. Burrows, St. Albans, 9.23; 2. P. Giggle, C.M., 9.02; 3. V. Jays, Surbiton, 8.36.

Flight Cup—1. F. Young, Birmingham, 7.58; 2. W. Cleghorn, St. Albans, 7.50; 3. C. Jackson, Surbiton, 6.01.

Fairey Cup—1. L. G. Barr, Hayes, 7.44; 2. D. G. Latter, Brighton, 6.35; 3. D. Fuller, Bristol & West, 5.49.

De Havilland Trophy—1. G. Fuller, St. Albans, 12.02; 2. Mussell, Farnham, 8.00; 3. J. West, Brighton, 6.55.

44 Power—1. R. Monks, Birmingham, 5.41; 2. A. Young, St. Albans, 5.10; 3. J. Berryman, St. Albans, 4.43.

R.A.F. Review Cup (Radio)—1. S. E. Uwins, C.M., 7 ft.; 2. C. Olsen, C.M., 13 ft. 6 in.; 3. Yates, N.L.S.M.E., 22 ft. 9 in.

Keil Combat Cup—P. Tribe.

Thurston Trophy—F. G. Boreham.

Concours D'Elegance. General Flying Models—C. Read. *Power Driven Models*—R. Brown. *Scale Models*—A. W. Evans. *Scale Models (Veteran)*—Mr. Clements.

Aeromodeller Challenge Trophy—(Gala Champion) J. Berrymar.

S.M.A.E. Centralised Speed Contest—*Wellesbourne*

THE inauguration last year of these centralised speed events, has, it is safe to say, provided the incentive necessary to improve the standard of British speed flying, which was at a very low ebb. Proof of this was in the outstanding results at the Nationals and although the speeds at Wellesbourne were, in comparison, low the meeting was well organised and enjoyable.

Interest in the F.A.I. class is not as great as might be expected, although the current availability of several new motors should have a beneficial effect, especially as next year will be the first World Championships under the "straight" fuel rules.

RESULTS

F.A.I.—1. P. Wright, West Essex, 109.1; 2. B. Hopkins, South Bristol, 100.3; 3. N. Butcher, Croydon, 99.4; 3. P. Drewell, West Essex, 99.4. (10 entries, 16 attempts.)

Class 1—1. R. Gould, FASTE, 104.0. (Two entries, three attempts.)

Class 2—1. G. Johnson, FASTE, 138.9 (Fox 29X); 2. J. Watson, West Essex, 134.7 (Dooling 29); 3. J. Taylor, Hayes, 124.9 (Fox 29R). (12 entries, 27 attempts.)

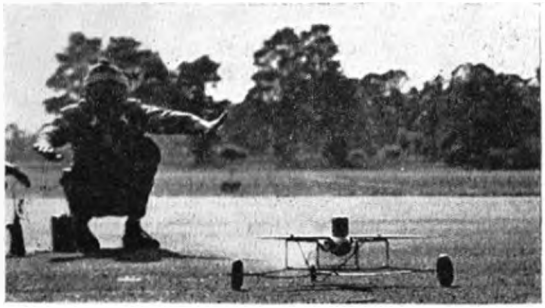
Class 3—1. M. A. Billinton, Brixton, 151.2; 2. P. Drewell, West Essex, 146.2; 3. D. Pinkert, FASTE, 145.2. (Seven entries, 14 attempts.)

Class 0 (*experimental* 1.5 *c.c. contest*)—1. H. Rey, Nuneaton, 79.3. (Two entries, four attempts.)

Clwyd Slope Soaring Contest

ON the morning of July 2nd, the slopes of Moel Famau near Mold, were invaded by aeromodellers from all over England, all suitably equipped for flying in the Slope Soaring contests organised by the Chester M.F.C. Conditions were not too good as the wind, although

Continued on page 299



At the S.M.A.E. Speed meeting Pete Wright (left) releases for Norman Butcher and (right) R. E. Lucas performs the same service for I. Roffey.

LETTERS
to the Editor

Mr. Weller replies

SIR,—May I respectfully suggest that when acting in his official capacity of P.R.O., London Area, S.M.A.E., P. Muller at least adopts the usual courtesy of checking the accuracy of his intended personal insinuations, before allowing them to appear in print under his signature. Would he please also make a point of interpreting correctly other people's correspondence.

Had he read my previous letter (M.A., June) intelligently, and in conjunction with the Editorial "Here and There" (M.A., April) to which I referred, he could not have failed to comprehend I was commenting on the possible effect of a proposal—another membership change—which had been, or was about to be, considered by the S.M.A.E. Council. He would also have noted that my remarks, some of which he quotes, referred mainly to possibilities open to an alternative national organisation, should the S.M.A.E. become, as I put it, a "closed shop" for the individual S.M.A.E. contest flyer only. Mention of the 10s. competition fee for an associate was made to give added emphasis to the preceding sentence and had no personal implication whatsoever.

Regarding the "associate problem," I must confess I am unable to extricate the P.R.O. and his London Area colleagues from their present dilemma. I have *never* been an associate member of the S.M.A.E. ! Surely the most suitably equipped persons to effect a rescue are the original sponsors of the scheme, or are they as ignorant of their reasons for introducing it, as I am ?

However, some years ago when associate membership was mooted I did write a personal letter to my old friend the S.M.A.E. chairman, warning him of possible consequences which might arise from the then proposed new form of membership. Among other things this is what I said: "You will create a vast army of displaced persons (aeromodellers of all denominations), who will sooner or later be kicking their heels for something to do and who may, for this reason, be compelled to start a rival organisation." Recent mutterings by "Pylonius" and the grouping of clubs in various parts of the country—quite independent of the S.M.A.E.—would seem to indicate there was some justification for my earlier warning.

Replying to the last paragraph in P. Muller's letter, may I say, as a regular reader of MODEL AIRCRAFT since the first issue, that I can see no particular reason why my personal views on matters read therein should be considered the exclusive copyright of members attending London Area meetings? In any case, my "fulminating in the Press" was in response to an invitation by MODEL AIRCRAFT (last sentence "Here and There" M.A., April) to "write and let us know what you think." Did this simple fact also elude the eye of my imaginative critic?

Finally, by way of a favour to Mr. Muller, may I just "elucidate" by saying I have paid a full fee to the S.M.A.E. since 1930 and prior to this, a country member's subscription which was then 6s. For the greater part of 30 years I have been the humble scribe to a model aeroplane club and, I sincerely hope, for a few more years—in spite of the P.R.O.'s fabrications—I may be privileged to continue to do just this.

Yours faithfully,
H. F. WELLER.

Bournemouth,
Hants.

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

More technical articles?

SIR,—I understand that the English Model Press, which caters for a variety of types of modeller, feels that technical articles have a limited appeal. While work of this type is accepted, there is invariably some considerable delay in publication and the quantity of such work made available is, therefore, limited. However, aeromodellers all over the world, interested in the development of high performance models for competition purposes, have made considerable progress. But, alas, much of their knowledge is lying dormant and unexchanged, due to lack of publicational facilities.

I would suggest to you that the majority of modellers, who enjoy reading your frequent and thorough reports and results of competitions, would equally enjoy reading a short, regular, well written article on the technical reasons behind why models win competitions. Of course the "experts" try to divulge their secrets from time to time, but invariably their articles suffer from two major limitations.

In the first place they attempt to convert the novice into an expert in about three pages of reading. This is quite impossible in the space available and the novice would feel the article too complicated, while the expert learns little from it. You cater admirably for the beginner, Wing's Club, etc.; surely the expert should get the same treatment? I do feel there is a place for articles written by experts, with experts in mind.

In the second place I find that some articles attempt to cover too wide a field. It is simply not practical to attempt to describe the design, development and flying of gliders, say, in the 2,000 or so words available. It would be far more profitable to concentrate on particular aspects, for example tow hooks and auto-rudders, or joining wing halves together and wing mounting.

You will, no doubt, say that this form of approach would take up more space, but consider how much more articles on these lines are appreciated and surely therein lies their justification.

Yours faithfully,
M. S. PRESSNELL.

Southend-on-Sea,
Essex.

The views of readers on this point would be welcomed.—Ed.

Found

SIR,—After the Midland Area Rally at Wellesbourne Mountford on June 11th, the following articles were found within the vicinity of the R/C flying area:

One Exide accumulator CZG4
Two tins of Super Power Mix diesel fuel

I should be grateful if the owners of this "gear" would get in touch with me.

Yours faithfully,
R. MASTERS.

30, Western Road,
Wylde Green,
Sutton Coldfield,
Warwicks.

The Editor welcomes letters for publication on any subject, but preferably of "newsy," topical interest or controversial nature. Address is "Model Aircraft," 19/20, Noel St., London, W.1.

MODEL AIRCRAFT WINGS CLUB

Secret of the Shed

DURING the early years of this century, a rumour came to Fleet Street, of strange goings-on in a quiet English village. So far as anyone knew, no scandal attached to the rumours—yet the reporters set out as eagerly as they would today, when a village has little chance of reaching the headlines, unless there is something nasty in somebody's wood shed.

The shed in this instance contained an invention. It also contained an inventor. He was there most of the time and anyone who knocked on the door was sent curtly away. No one knew what he had invented, or was hoping to invent, but by bribing the villagers with quarts of home-brew—cheap in those days—the journalists picked up enough clues to tell them what kind of thing was inside the mysterious shed.

It was an aircraft and from what the villagers said it seemed to be an extraordinary one, even for the 1900s, when all kinds of alleged aircraft were being contrived. A daring rustic, who had risked a peep into the shed, declared that the machine looked like a ship. Another described it as a contraption half-way between a motor car and a reaping machine.

The inventor inevitably refused to comment, when the reporters asked him about the aircraft. He moved about with a pre-occupied air and snorted whenever anyone approached him.

One day strange noises were heard from the shed. While villagers and reporters peered from their places of hiding, the doors were suddenly flung off. Dimly through clouds of dust, the watchers saw a large swaying contraption, with several revolving propellers and wings like Venetian blinds. In the middle of it all sat the inventor, wildly working his hands and feet to operate levers and looking rather desperate from the first.

It was obvious that the machine had taken control and that the Frankenstein who had made it, was as helpless as if he were on the back of a charging rhinoceros. It swooped to the right; it swooped to the left; it bounced and see-sawed. The only direction in which it did not move, at least for more than a few inches, was upwards.

By the time that the contraption had quite clearly stated its intention of remaining on the ground, an obstacle intervened. In England, an aircraft which insists on taxiing indefinitely, is bound to meet a hedge. This one met it full-on. Despite the frenzied leverings of the inventor, it struck the barrier with a tremendous crash.

Before the watchers reached the scene, the mystery man (as he would no doubt be called today) emerged from the ditch on the other side. He was completely unhurt. When the others began to sympathise, he waved them aside, pulled some wires from the back of his neck and stalked off with his customary dignity, leaving his cherished secrets scattered, for what they were worth, over the dewy grass.

There were many others like him in those years and wonderful were the machines which they devised—weirdly intricate, wobbly, full of wires and levers and capable of quite remarkable speeds on the ground. We know what happened to most of these juggernauts; sooner or later (and usually sooner) they fell to pieces. But what happened to the men who made them? Did they return to their banking or bee-keeping? Did they, with equal confidence, proceed to invent something else? We know what happened to a few of them, but of the others nothing is known except, of course, to their relatives and friends, and to the village ancients, who can tell you a story or two about the roofless, empty shed, up in the far corner of Church Field.

ALAN WINTERTON.

Dear Alan Winterton—I am between 10 and 16 years of age and would like to become a member of the Model Aircraft Wings Club. With this coupon I enclose a postal order (overseas readers should send an International Money Order as local postal orders cannot be cashed in England) for 1/- to help cover the cost of the badge, transfers and membership book. *All membership applications must be on this form.*

Name in full.....

Address.....

.....

..... Year of birth.....

School or College.....

Name of other club or clubs to which I belong (if any).....

.....

Send to—MODEL AIRCRAFT WINGS CLUB, 19-20 NOEL STREET, LONDON, W.1

Wings Club Workbench . . .

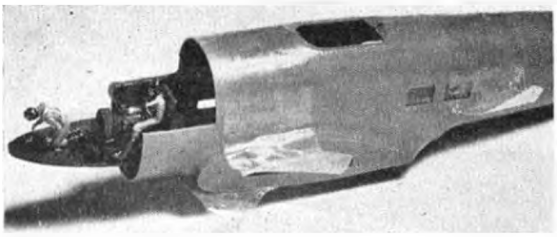
More on Plastics

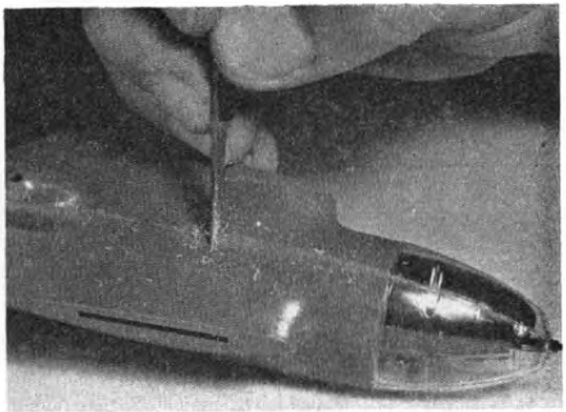
OUR Plane of the Month is the Spanish *Casa* 2111 which, as you will read, is really a Heinkel He 111 of World War II fame. Since there is a Lindberg kit of this aeroplane, we thought it would be a good idea to paint it up as the *Casa* and the plan and side view photographs on page 288 are, in fact, of our completed model.

Before the final painting stage is reached, however, there is quite a lot of careful assembly to be done, and as it is some time since we last devoted a Workbench to plastics, we took the opportunity of photographing some of the more important stages of assembly, during the building of our model.

Older readers will be well aware of these hints, but newcomers are constantly joining our ranks and it is for them that this feature is presented.

The Heinkel has particularly large transparent areas around the nose, so it





Above: interior detail completed, adhesive tape holds the fuselage shells together until the cement dries.

Right: using a sharp blade to remove ridges.

is very important to paint the internal detail before assembly. You will find that small intricate painting jobs, such as pilots, are much easier to carry out while they are still attached to the moulding "trees," as shown in our photo. In the same picture you will notice part of a disused "tree," sticking out of the enamel tin. These otherwise wasted pieces make ideal paint stirrers, and with matt colours it is particularly important to stir thoroughly, as otherwise the colour dries streaky.

Our aircrew were given blue-grey flying suits, with white parachute straps and black helmets and flying boots. Incidentally, a good flesh colour can be mixed up using white, with a little yellow added and just a touch of red.

The cockpit floor, instrument panel and pilot's seat were all painted matt black and this assembly is shown, with the pilot and gunner in position, in our second photo. Another useful point to notice in this picture is the adhesive tape holding the two fuselage shells together until the cement dries. Rubber bands are also useful for this job.

Before sticking any parts together, it is always wise to assemble them "dry," to make certain they fit accurately. Sometimes it will be found necessary to cut, or sand away small pieces of plastic that prevent the two parts "mating" properly. Remember, it is too late to do this once the cement has been applied.

The unsightly ridges, formed when two shells are stuck together, should be removed, but the cement must be allowed to dry out completely before this is attempted. The easiest method of eliminating the joint line is to scrape the ridge down to the level of the adjoining plastic, using a sharp blade exactly at right angles to the surface, as shown in our third photo. No. 400 "wet or dry" abrasive paper will remove any scratches remaining following this operation and careful scoring with a sharp point will replace lost panel and rivet detail.

The Lindberg Heinkel has, for once, a completely retractable undercarriage with operating wheel well doors, and to ensure the correct working of the parts, close attention must be paid to the instructions. It is as well, after cementing the undercarriage parts in place, to allow them to dry overnight to allow the cement to set really hard before operating the retracting gear, because quite a lot of strain is imposed on some joints during retraction. We would also advise those who build this model to ensure correct undercarriage operation *before* fitting the top wing surface.

Our Heinkel was painted in the splinter camouflage pattern, employed before the war by the *Luftwaffe* and perpetuated by the Spanish Air Force after the Civil War, right up to recent times! As you will read on page 289, the *Casa* 2111 was later fitted with Rolls-Royce Merlin engines and these aircraft were nearly all left in their natural aluminium colouring.

It would not be difficult to modify the Heinkel to represent one of these machines, by making two new wooden engine nacelles ahead of the wing leading edge and dispensing with the existing ones. It should be possible to employ the kit propellers by slightly altering the spinner shape. A photograph of a Merlin engined 2111 also appears on page 288.

The red, yellow, and red Spanish roundels are the most difficult item of the decoration since, to the best of our knowledge, no transfers of this type are available. The easiest way round the difficulty is to use a pair of ink compasses, charged with enamel, to outline the discs and filling in afterwards with a small brush. The squadron numbers 14-26 are standard $\frac{3}{8}$ in. black numeral transfers.

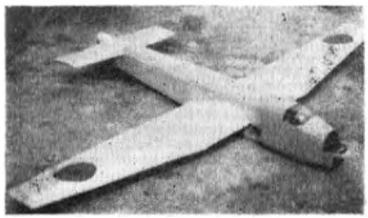
Wingmen write . . .

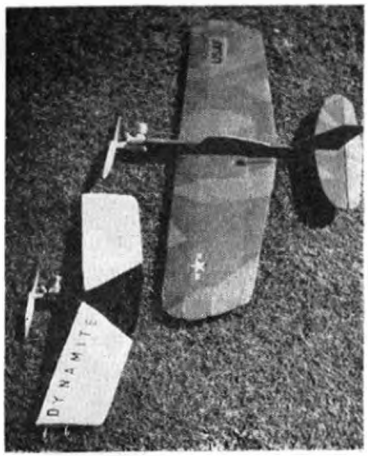
I thought you might be interested in this photograph of my Handley Page *Halifax* non-flying scale model. It is about 50 in. wingspan and is constructed mostly of $\frac{1}{8}$ in. square covered with 1/32 in. sheet. Up to now it has taken me two years to build, and I am going to finish it as the first prototype *Halifax*.

Yours faithfully,

PETER NOBLET.

Barrow in Furness.





I thought you might be interested in this photograph (left) of my two planes. I call the large one the *Cougar* and it is an extremely good stunter, powered with a Rivers Silver Arrow and covered with silk. It is camouflaged grey green, with black undersides.

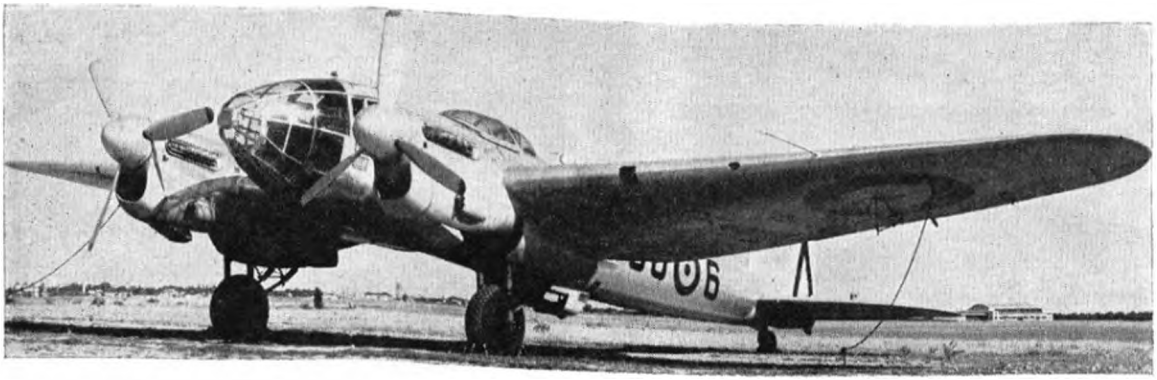
The small one is a combat wing, powered by an A.M.15.

Yours faithfully,

PAUL JACOBS.

Taunton, Somerset.

I am always pleased to receive letters and photographs from Wingmen telling me of their activities. Remember, I pay 5s. for every letter published and 10s. if a suitable photograph is included.—Alan Winterton.



John W. R. Taylor's Plane of the month

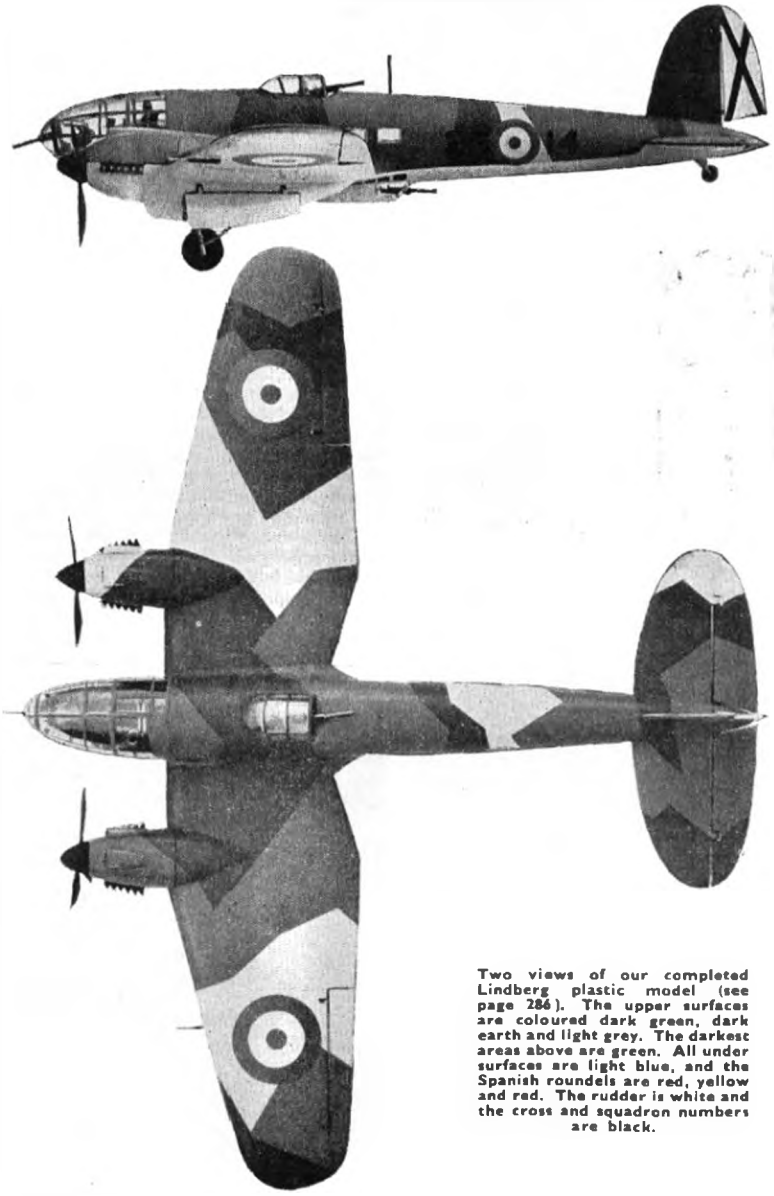
The CASA-2.111

THE CASA 2.111 is the basic designation of the Heinkel He 111 H-16 bomber as built under licence by Construcciones Aeronauticas S.A., at Seville, for the Spanish Air Force. Its story started, therefore, some 27 years ago when designers at the Ernst Heinkel Flugzeugwerke began developing a twin-engined medium bomber for Hitler's still-secret *Luftwaffe*.

The prototype He 111a was flown for the first time early in 1935 and made its public debut at Tempelhof Airport, Berlin, on January 10th, 1936. It was referred to as a ten-passenger commercial transport, but nobody was surprised when production models sprouted guns and a glazed bomber-nose. Like other *Luftwaffe* aircraft, they received their baptism of fire with the Condor Legion in Spain, making their first raid on a Republican airfield in March, 1937. We need no reminder of the later combat record of the He 111 in World War II.

By the end of the war it was thoroughly outclassed, but this did not seem to worry the Spaniards. They had acquired the licence to build the He 111 several years earlier and the first of the 236 aircraft ordered from CASA had been delivered late in 1941. Although redesignated CASA 2.111, it was virtually identical with the He 111H-16 and was powered by German-built 1,340 h.p. Junkers Jumo 211F engines.

The supply of Jumos soon dried up, but CASA carried on hopefully with airframe production. They had sufficient engines for about 130 of the aircraft; the others gradually piled up at their works until 1956, when it was decided to adapt them to take two 1,400 h.p.



Two views of our completed Lindberg plastic model (see page 286). The upper surfaces are coloured dark green, dark earth and light grey. The darkest areas above are green. All under surfaces are light blue, and the Spanish roundels are red, yellow and red. The rudder is white and the cross and squadron numbers are black.

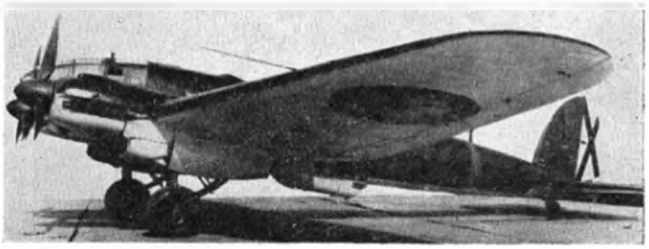
Rolls-Royce Merlin 500-29s, similar to those already going into Messerschmitt Bf 019s built in Spain by Hispano.

Because of engine and airscrew changes and the fact that the design has been adapted for other duties, there have been no fewer than 16 different versions of the CASA 2.111. The ten variants with Jumo engines covered by the Spanish Air Force designation B.2H were as follows:

C-2.111-A. Bomber. Junkers VS 11 airscrews.
C-2.111-A1. As C-2.111-A, but different radio.
C-2.111-A2. As C-2.111-A, but de Havilland airscrews.
C-2.111-A3. As C-2.111-A2, but different radio.
C-2.111-C. Reconnaissance aircraft. As C-2.111-A.
C-2.111-C1. Reconnaissance aircraft. As C-2.111-A2.
C-2.111-C2. Reconnaissance aircraft. As C-2.111-A3.
C-2.111-C3. Reconnaissance aircraft. As C-2.111-A.
C-2.111-F. Flying trainer with dual controls. As C-2.111-A.
C-2.111-F1. Flying trainer with dual controls. As C-2.111-A2.

The following Merlin-powered versions are designated B.2I by the Spanish Air Force.

C-2.111-B. Bomber. Rotol airscrews.
C-2.111-B1. Bomber. De Havilland airscrews.
C-2.111-B2. As C-2.111-B1, but with Sperry autopilot.



Heading photo on opposite page shows a Merlin powered C-2.111.

Above: A Jumo C-2.111—virtually a Heinkel He.111 complete with pre-war "splinter" camouflage.

C-2.111-D. As C-2.111-B1, but equipped for reconnaissance.

In addition there are two transport versions with Jumo engines, designated T-8 by the Air Force:

C-2.111-E. De Havilland airscrews. Dual controls.
C-2.111-E1. As C-2.111-E, but no dual controls.

The bombers all carry a crew of five and normal load of eight 550 lb. bombs, stowed vertically in individual cells on each side of a gangway in the fuselage. Armament comprises a 20 mm. MG-FF cannon or 12.7 mm. Breda machine-gun in the nose, a 7.9 mm. MG-15 machine-gun in the dorsal position and a further MG-15 in the ventral turret. In the reconnaissance-bombers the starboard bomb-bays are replaced by a camera installation. The trainers have inward-facing bench-type seats in place of both sets of bomb-racks, and the T-8s have a properly furnished cabin with nine seats, for use as command transports.

The fact that these aircraft are still in first-line service is a tremendous tribute to the men who designed them back in the 'thirties. However, the story might have been different if, in the intervening years, they had not been able to acquire engines of the kind fitted in the *Spitfire* and *Hurricane* fighters which shot the original He 111s from the sky over Southern England 21 years ago!

Data (*C-2.111-D*): Span 73 ft. 9½ in.; length 54 ft. 1½ in.; wing area 931 sq. ft.; normal max. weight 26,455 lb.; overload max. weight 30,865 lb.; max. cruising speed (emergency) 260 m.p.h.; economical cruising speed at 19,000 ft. 233 m.p.h.; service ceiling 27,900 ft.; range 1,550 miles.

Multi Super-60

Continued from page 276

cure for it many moons ago (see "Letters to the Editor," M.A., January, 1961). It *can* sometimes be reduced by fitting a large and inefficient prop, so greatly reducing the power output, but my tried and proved method is merely to take firm grasp of a tenon saw, a careful eye on the exact line of demarcation and make a clean cut right through the nose (in this case immediately forward of the ply bulk-head). Half an inch is then cut off the rear end of the now separate engine pod, an ⅛ in. ply plate fitted and suitable dowels inserted for rubber band retention. The essential addition is a sheet of ⅛ in. thick "Dunlopillo," cemented to the back of the engine pod. When this is sandwiched between the latter and the front of the fuselage, all vibration troubles miraculously disappear.

All these modifications can be clearly seen in the photographs. The all-up weight of the completely equipped model is 5 lb. 11 oz. Taking the wing area as 600 sq. in. this gives a wing loading of just over 21 oz. per sq. ft. which, with full control, is not excessive. My multi *Super* 60 flies fast (but not out of all proportion to its size!) and looks very realistic in flight. Ample height is needed for rolls, as, with a lifting wing section, there is a tendency to lose height in the inverted phase of the roll, but this actually *improves* the appearance of the manoeuvre, as it approximates more closely to a barrel roll.

The best method of achieving a really pleasing-looking roll is to put the model into a shallow power dive to build up air speed, then neutralise the elevator, when the plane will zoom up into a shallow climb—then apply full aileron and the aircraft will perform an almost perfect barrel roll, coming out straight and level.

All directional control in the air is, of course, obtained by aileron movement and this should be "pulsed" manually —once the model is set in a bank, it will hold this degree of turn for at least half a circle and the degree of control on the turning circle, is far more effective with ailerons than with rudder. Also, there is far less tendency to spiral, and the "sense" of direction remains constant whether the aircraft is upright or inverted.

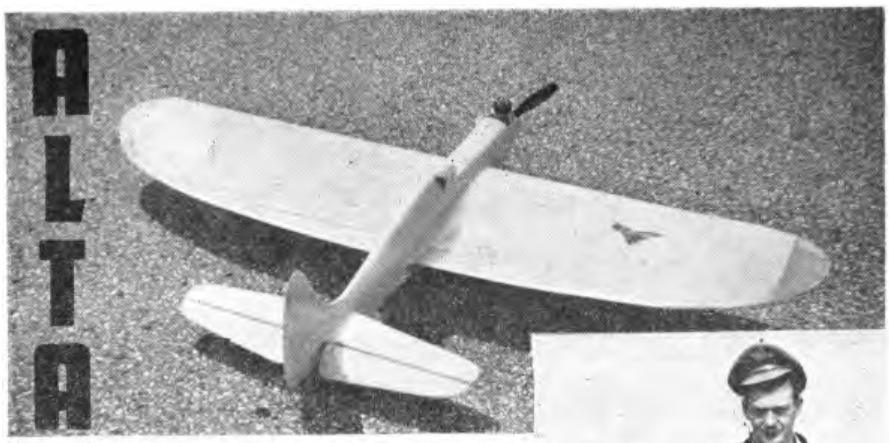
Loops and bunts are simple and straightforward, while Immelman turns (half-loop followed by a half-roll) are achieved simply by applying full ailerons at the top of the loop, neutralising as soon as the model is right-way-up. Fast turns (as in pylon racing) are obtained by banking the model steeply, applying up-elevator, then opposite aileron to level out on completion of the turn.

When coming in to land, allow the model to follow its normal attitude (on low power) until it is almost down, then pulse up-elevator judiciously to level off for a 3-point touch-down. The rudder movement must be much greater than for S/C if true spins are to be achieved, about 20 deg. either side. Response throughout is remarkably good, and, even with the reduced dihedral, the model will happily look after itself for quite long periods without attention, thanks to the built-in design characteristics.

In conclusion, I can thoroughly recommend the *Super* 60, as modified above, for any modeller seeking a reliable, stable, and yet very manoeuvrable sports R/C multi aircraft. Just one final word of warning—with the heavier payload of multi equipment, plus the far greater stresses involved in acrobatic manoeuvres, the wing does need strengthening, otherwise it is liable to fold up! This can be done by fitting larger and stronger ply braces, etc., but I prefer aluminium tube struts. These had not been fitted when the photographs were taken, but have been since, and easily take care of the stresses. They also accentuate the scalish appearance of the model.

ALTAGERRA

A '35' STUNT MODEL



designed by

A. PHIN

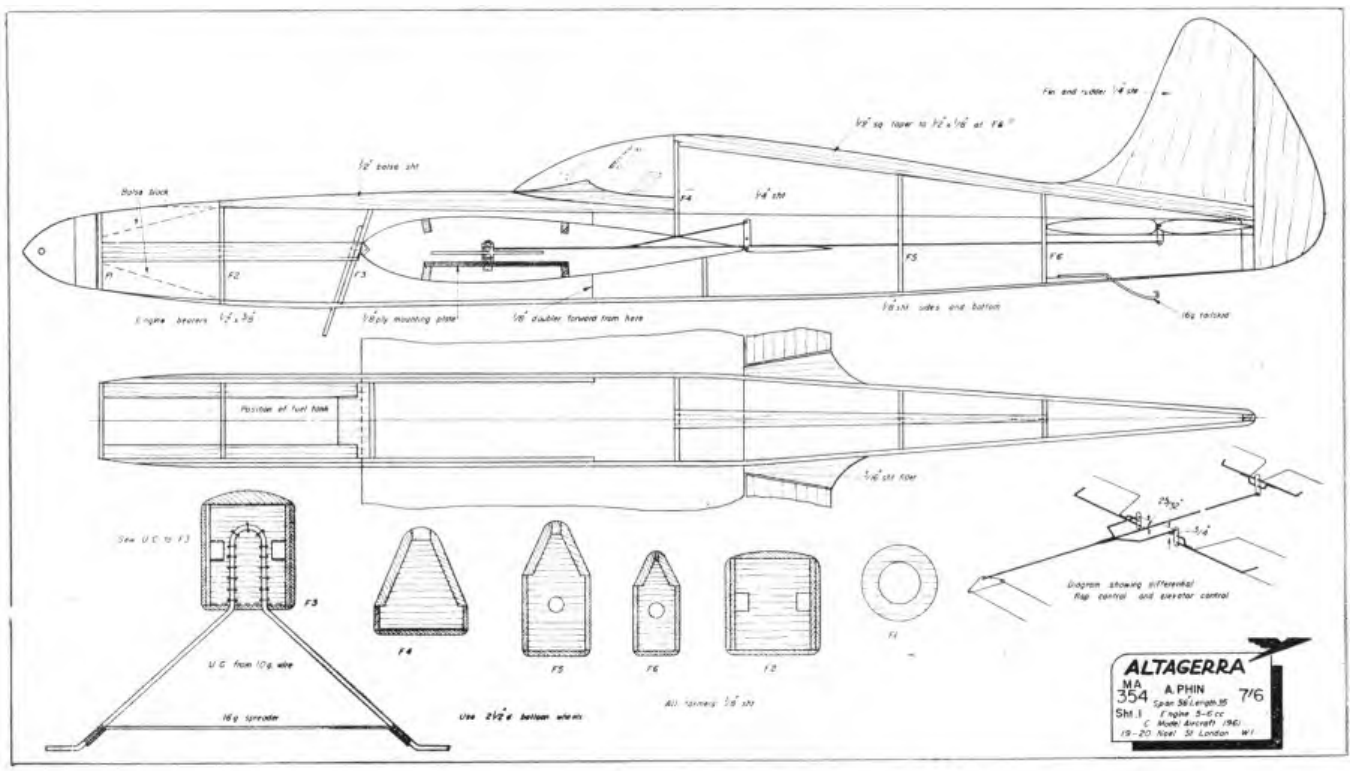
THE name *Altagerra* (with the accent on the "g") means "The giver of life." Well the "life" of this model depends on the pilot, but it is easily capable of flying the book and will perform equally well on 50 or 60 ft. lines, although more latitude is obviously given with the latter.

Construction

Commence with the wings, cutting out 16 W.1 ribs from $\frac{1}{16}$ in. sheet balsa and two from $\frac{1}{4}$ in. hard sheet, also two W.2's and W.3's from $\frac{1}{16}$ in. sheet. Now cement the ribs to the $\frac{3}{16} \times \frac{1}{4}$ in. mainspars, making sure that the spar joints are staggered. The two $\frac{1}{8}$ in. W.1's are fitted on either side of the bellcrank mount.

Cement the $\frac{1}{16}$ in. sheet T.E. in position, followed by the $\frac{1}{16}$ in. spars, again being careful to stagger the upper and lower joints. The $\frac{1}{4}$ in. sq. leading edge can now be fitted. Cut out the wing tips from $\frac{1}{8}$ in. sheet and cement them into position, together with the wingtip gussets. Cover the leading edge of the wing with $\frac{1}{16}$ in. sheet back to the mainspar.

Fuselage. Cut out the fuselage sides and doublers from $\frac{1}{8}$ in. sheet and cement together, then cut out formers F2 and F3. Mount U/C to F3, and bind on with strong button thread, cementing well. Drill a hole for the



fuel line in F2 and cut two holes in the fuselage (port side) for the tank vents. Do not cement the fuselage sides to the formers until the wings have been completed.

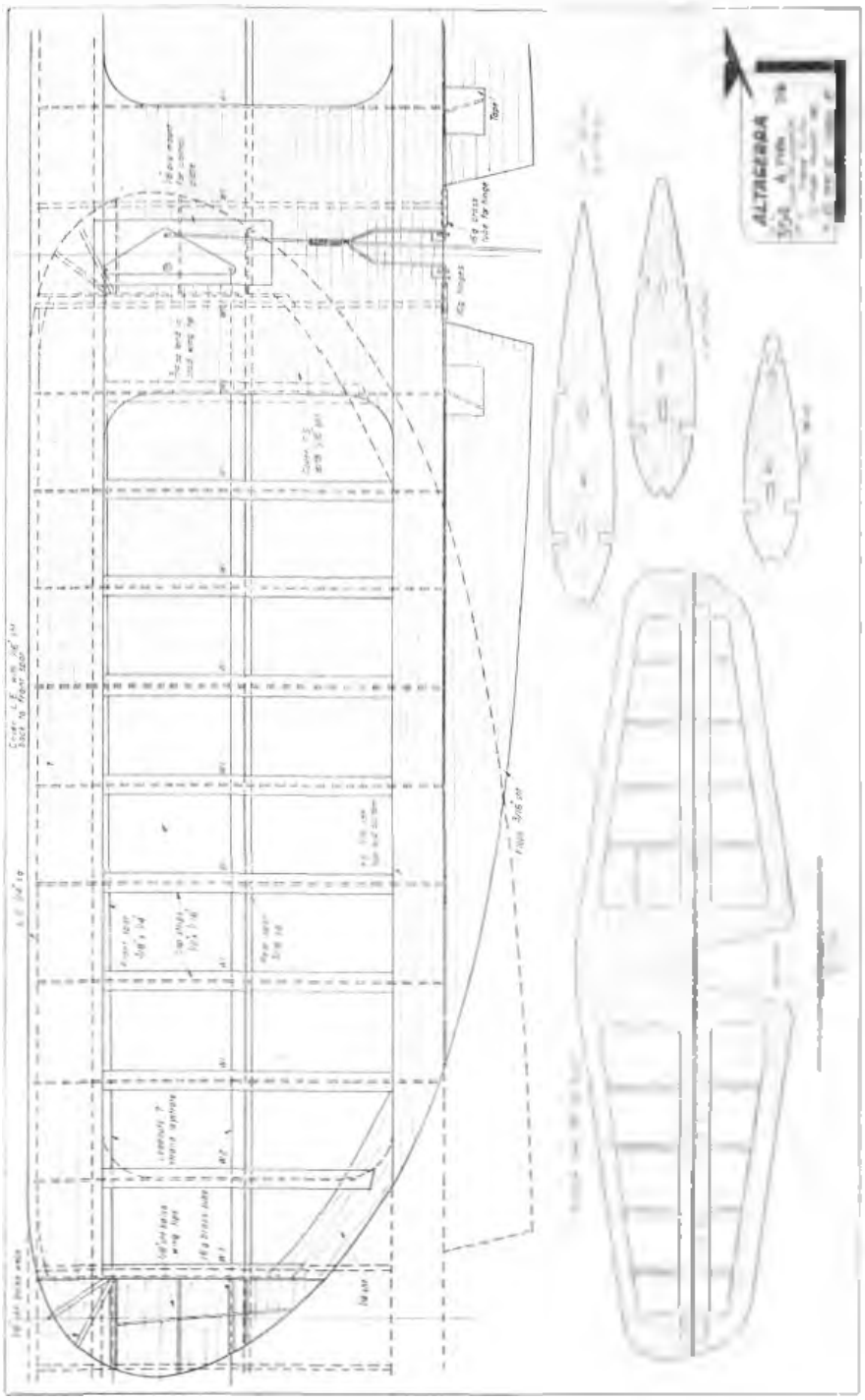
Cement the $\frac{3}{8}$ in. × $\frac{1}{2}$ in. engine bearers to the fuselage as indicated on the plan, then cut out the remaining formers. After mounting the bellcrank in the wing, slide both fuselage sides down the wing and cement into place, positioning F2 and F3 at the same time, along with the fuel tank.

Cut out the tailplane, and separate the centre section and the elevators, then cement the $\frac{1}{8}$ in. × $\frac{3}{8}$ in. strip in place. Complete the tailplane by sanding leading and trailing edges to the section shown. The elevators are next assembled and fitted. Cement formers F4, F5 and F6 in place, then cement the rear fuselage ends together, separated by a scrap piece of $\frac{1}{4}$ in. sheet.

Fit the tailplane and connect the push-rod to the elevator horn. Mount the flap horns and fit the push-rod. Use 1 in. linen tape for flap hinges and cement tape securely around flap and flap horn. Use $\frac{1}{2}$ in. tape for elevator hinges, with 1 in. tape to reinforce the elevator horns.

Cement the tapered $\frac{1}{2}$ in. sq. strip balsa spine to the fuselage top and then fit the $\frac{1}{4}$ in. sheet sides; sand to a rounded section when dry. Cement the $\frac{1}{4}$ in. sheet fin and rudder in position incorporating 10-13 deg. The $\frac{1}{8}$ in. sheet forward fuselage decking is next cemented in place and carved to shape when dry. Cement block balsa either side of the bearers and round off to F1. Cut away the top block to fit around the engine and cover the entire fuselage with lightweight Modelspan.

Finish. Cover the wings and tailplane with heavyweight tissue or nylon and give the whole model two to three coats of clear dope, followed by a coat of sanding sealer, before finally colour doping and fuel proofing.



FULL SIZE WORKING DRAWINGS ARE OBTAINABLE FROM YOUR LOCAL DEALER, OR BY POST FROM THE "MODEL AIRCRAFT" PLANS DEPARTMENT 19-20, NOEL STREET, LONDON, W.1, PRICE 7s. 6d., (TWO SHEETS) POST FREE

RADIO TOPICS

AT last, even the experts seem to be agreeing on that tricky subject of undercarriage design and layout. The tricycle gear with steerable nosewheel looks like gaining general favour for "multi," if not universal acceptance. Weight penalty is relatively small—a matter of about three ounces on an *Orion*, for example—and since you can use smaller wheels there is not a great deal of extra drag. The trike gear may slow down the model a little bit (which is not a bad thing), but has little or no effect on manoeuvres.

Ed. Kazmirski has come up with a real "modeller's solution" for the *Orion*—and obviously adaptable to other designs—with wire nosewheel leg, pivoted in nylon bearings and nylon bellcrank push-pull control. The complete gear unit is being manufactured by Top Flite and sold as a kit (retail price 84s. in this country and available through Ed. Johnson). Nosewheel steering is linked to the normal rudder servo. Brakes can also be used on all three wheels, working off the elevator servo on 8-channel, or the elevator trim servo on 10-channel. The complete system is highly practical, simple—and really worthwhile.

Chief advantages claimed for "trike" gear with steerable nosewheel (and brakes) are complete ground manoeuvrability, smoother landings and take-offs, positive steering and ground stability when taxiing, even in high winds. Tricycle gears do not "bounce" on landing, unless you touch down nosewheel first and with elevator control, to look after the landing approach, the nosewheel leg is not subject to heavy shock loads. It does, however, need the big "multi" model to bring out its advantages fully, as trike gear on a small single-channel job seems to spend most of its life making "one-point" landings—on the nosewheel!

* * *

Corresponding broadly in purpose to the L.S.A.R.A. Reports initiated in this country a decade ago, but dealing specifically with radio control subjects, the District of Columbia Radio Control Club and the (American) Academy of Model Aeronautics have jointly sponsored a number of technical symposia (assuming that is the correct plural of "symposium"), now generally available in the form of a collection of articles. Subject coverage ranges from aerodynamic design, stability, ancillary equipment, circuitry, new ideas on receivers and transmitters, to purely practical "results" papers. Each technical symposium runs to about one hundred pages of typewritten and illustrated matter with litho reproduction and embraces about half-a-dozen different articles. The first was published in 1958 when symmetrical wing sections were just becoming "the thing" (as very well described by Harold de Bolt), with further volumes giving selected papers from the 1959, 1960 and 1961 meetings. All make most interesting reading for the serious enthusiast and contain a wealth of information—provided it is borne in mind that these are articles or "lecture papers" and not necessarily the "last word" on particular subjects. Some of the theories, for example, are given a neat little "twist" to fit a practical situation. Equally, some of the practical articles are just a series of tests and not necessarily exhaustive or conclusive.

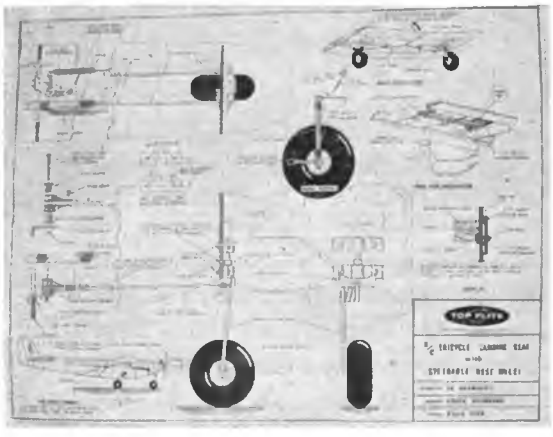
However, we can thoroughly recommend each one as worth reading and for those interested, copies can be ordered direct (price 10s. 6d.), from the Academy of Model Aeronautics, 1025, Connecticut Avenue, N.W., Washington 6, D.C., U.S.A.

* * *

The trouble we had recently in convincing a would-be manufacturer that 10-channel equipment was necessary. "Based on our market survey, fours and sixes are most popular." (Naturally—there is a fair difference in price in their favour.) "Eight channels cover rudder, elevator, ailerons and motor control. What more do you need to fly a model?" (Well, why not try flying one and see; elevator trim control makes all the difference.) And so on, until. . . . "Yes, perhaps you're right. But why stop at ten. We could offer twelve, fourteen, sixteen. . . ." (Help! Ten channels is *enough*. Most of us can't afford even that, anyway.) "Oh! in that case we think that fours and sixes would be the most popular. . . ."

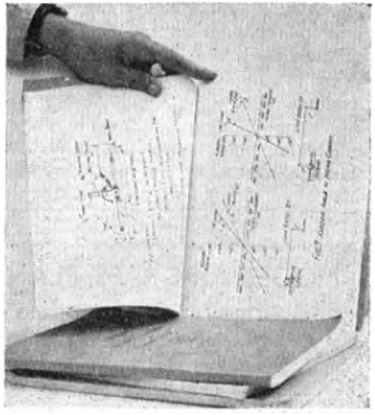
* * *

Reader D. G. Barnes asks: "Can you use a motor servo on single-channel—and if so, can we give circuit diagrams?" We will dodge the latter part—designers of motor servos seem to find inexhaustible sources of different wiring and circuit "trickery"—but operation of an ordinary *multi-servo*, normally designed to operate off two separate channels, simply demands two separate switching contacts (to operate progressively); or two separate *sets* of contacts to operate with self-neutralising action.



Left: Tricycle steerable nosewheel with brakes designed by Ed Kazmirski. Obtainable in kit form (see text).

Right: Technical R/C Symposia obtainable from Academy of Model Aeronautics.



This can be done with a single-channel system. It simply means using an ordinary actuator as a switch and providing it with the necessary contacts—see Fig. 1. The swinging contact leaf represents the common armature connection to two separate relays (on multi-channel set-up) and the contacts, the separate relay contacts. Bonner detailed this hook-up in his original " Duramite " instructions and it really is a most practical scheme, if you are bent on using a multi-servo with single-channel radio. The trick lies in using a fairly flexible leaf for the swinging contact arm, so that the escapement stops in its normal position and it is not stopped by the contact leaf making against the contacts.

* * *

This use of an escapement as a switch for a multi-servo offers a means of using coupled rudder and ailerons with straightforward single-channel equipment. A number of full size lightplanes couple ailerons and rudder to a single control movement, to arrive at simplified piloting. It seems to work quite well, too. Any rudder-only model can use coupled ailerons by adapting the actuator to switching, as shown in Fig. 1, as well as normal rudder operation via standard linkage. Mount a " Duramite " or similar multi-servo in the centre of the wing linked to ailerons and every time you signal " rudder," you get a corresponding aileron movement as well (provided you have wired the aileron servo up the right way).

You need two separate batteries for the servo, of course, and these had better be additional batteries. But look what you get for very little extra cost and complication:—

(i) Normal " bang-bang " rudder.
(ii) Motor control (if you are using a compound escapement).
(iii) Aileron control.

That's six-channel coverage in a *practical* manner without complicating the button-pushing. Of course, it is not true six-channel *equivalent*. You cannot, for instance, use the ailerons independently.

Frank Van den Bergh, Dennis Allen and the famous VDB " Sky-Duster " at Biggin Hill testing out the new Merco 49 engine (see Latest Engine News). Photo by Bill Morley.

* * *

Mini-Reptone circuit has, we understand, been slightly modified to decrease the somewhat extreme sensitivity which seemed to be an inherent characteristic of the original. As a result it should be that less subject to interference from " noise," without detracting from favourable operating characteristics. Anyone who has experienced " second actuator " trouble with Mini-Reptone, incidentally, should try an Elmic " Conquest."

* * *

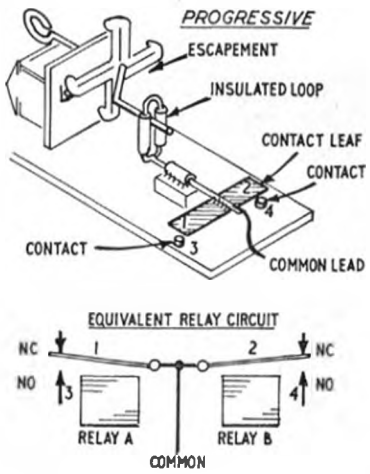
Question from another reader (would-be home constructor?) raises a point of considerable controversy. He simply wants to know—what is the best material (metal) to plate reeds with?

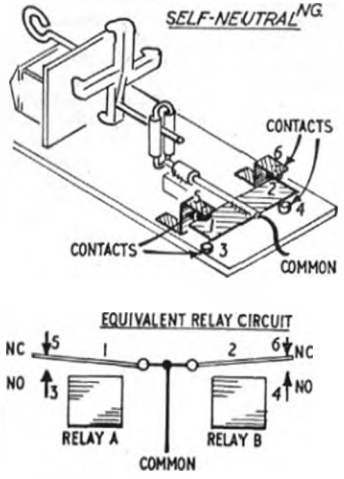
The controversy ranges not so much around a suitable choice of plating metal, but whether reeds should be plated at all for " optimum " performance. Plating will modify the mechanical properties of any metal and, in particular, usually produces " hydrogen embrittlement," which means that in the case of reeds the parent metal is that little bit less elastic or springy. That would not matter so much—except that different degrees of embrittlement can be produced by quite small changes in plating conditions. What does matter, though, is that this " embrittlement " gradually wears off when the reeds are in use, so that the resonant frequency is tending constantly to shift. A plated spring, too, being of bimetal construction, is also liable to suffer a frequency shift with changes of temperature.

What happens if the reed is left unplated? Well, any corrosion products formed on the surface may also modify the mechanical properties and shift the frequency. Also, of course, a corroded reed will not make good electrical contact with its mating fixed contact. If the reed is kept reasonably free from corrosion, the latter condition does not seem to arise. Working against silver or gold contacts, for instance, there is usually a metal transfer (if the current polarity is the favourable way round) to deposit a silver or gold " contacting surface " on the reed just—and only just—where it is needed for optimum conductivity.

The answer seems to be to use unplated reeds, and keep them from corroding. If corrosive conditions do exist—a sea air atmosphere will attack almost anything, for instance—then a plated reed will almost certainly be best. Gold plating? Silver? Rhodium? We'll pick the former as being the best contact metal and the softest one. But what about cadmium? Here is a non-noble metal which does produce passive surface corrosion—but the interesting thing here is that the corrosion product is a good electrical conductor.

To save writing a treatise on reed bank troubles, we had better leave the subject at that point. . . .

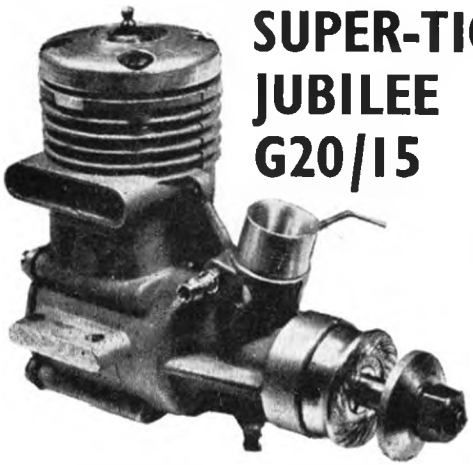




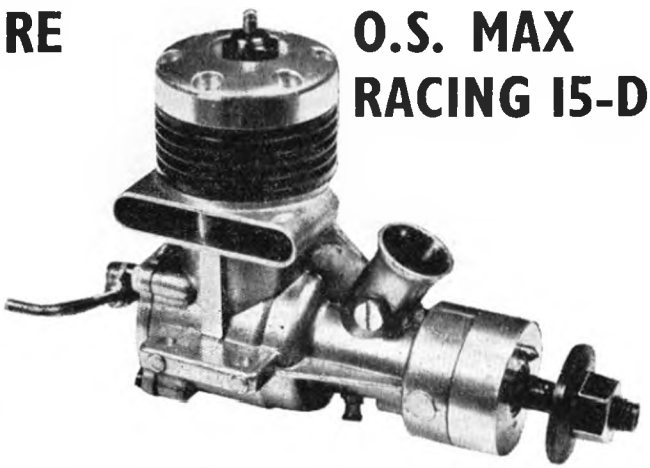
MODEL aircraft

ENGINE TESTS

TWO OUTSTANDING INTERNATIONAL CLASS 2·5 c.c. RACING GLOWPLUG MOTORS



SUPER-TIGRE JUBILEE G20/15



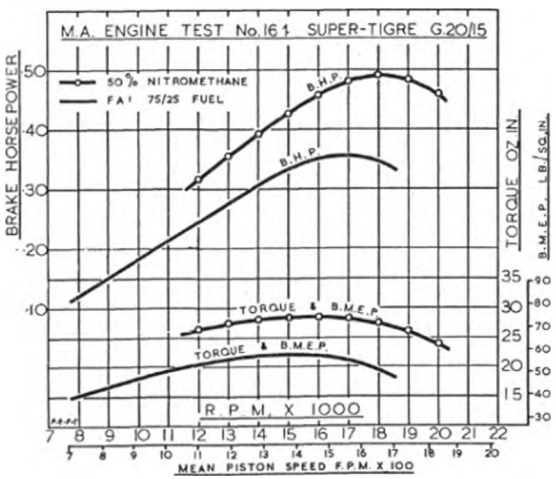
O.S. MAX RACING 15-D

IN last month's issue we dealt with two of the leading 2.5 c.c. contest engines currently available: the latest factory-modified British Oliver Tiger Mk. 3 and the American Cox Tee-Dee 15. We now turn to two very powerful contributions from Italy and Japan: the 1961 Super-Tigre G.20 and the O.S. Max-D 15 racing glow engines.

Super-Tigre G.20/15 Jubilee 2.47 c.c. Glowplug Engine

In the F.A.I. 2.5 c.c. speed class, the Super-Tigre G.20 stands out as being the only commercially built motor that, during the last few seasons, has been able to compete with, and often beat, the top specialist-built motors from all over the world. Last year, the then new *Giubileo* ("Jubilee") model showed itself capable of speeds, in F.A.I. class speed models and using nitromethane, of 130 to 140 m.p.h., depending on state of tune, and a new U.S. National Class A speed record of 145.1 m.p.h. has, this year, been set up with one of these engines.

The example submitted for our tests was one of the latest revised 1961 model Jubilees, which has a number of modifications by comparison with the 1960 version described in Latest Engine News, MODEL AIRCRAFT, September, 1960.



The former, generous, 7 mm. gas passage through the shaft has been opened up to 7.5 mm. (0.295 in.) and the valve port has been lengthened from 11 mm. to 13 mm. and also widened. Rotary valve timing is now 35 deg. to ABDC to 55 deg. ATDC, a 10 deg. increase in the intake period to 200 deg. of shaft rotation. The throat diameter of the "speed" venturi insert, incidentally, has been reduced from 9.5 mm. to 8 mm. The main casting has been slightly modified and has a deeper web between the cylinder casing and intake boss. The former arrangement of using two extra long cylinder head screws on the exhaust side, extending through the cylinder block and screwing into the casting below the exhaust duct, has been abandoned. The piston has been lightened and the gudgeon-pin bosses enlarged. The crankcase backplate is now deeper, to increase primary compression.

The worth of these modifications is seen in the phenomenal performance of the 1961 Jubilee Tigre which, in the case of our stock example, is obviously equal or close to most of the specially tuned 1960 versions used in contests last year.

The general design of the Jubilee G.20 is an interesting example of 2.5 c.c. glow engine development. As has been previously mentioned in MODEL AIRCRAFT, its most unusual feature is the transfer timing which, at 65 deg. BBDC to 65 deg. ABDC, is the same as that of the exhaust, despite the fact that no baffle is used on the piston, the only guide to the upward flow of fresh gas into the cylinder being the 45 deg. chamfer on the edges of the twin transfer ports. These ports are very large in area and occupy approximately 160 deg. of the cylinder circumference at their bottom edges, tapering inward at the top. Head design is quite simple, the internal contour being a flat curve from side to side.

The intricate main casting of the Jubilee G.20 comprises crankcase, complete cylinder block and main bearing housing, in a single pressure cast unit,

with integral intake boss, exhaust duct, beam mounting lugs, etc. As sold, the engine is equipped with a 6.5 mm. choke insert which is further restricted by a 4 mm. spraybar. Each G.20/15 is, however, supplied with a "speed" insert that can be fitted in place of the standard venturi. This has an 8 mm. bore and, with it, the spraybar is re-located in the rear of the carburettor boss so as to leave the full diameter unrestricted. When so fitted, a pressurised fuel supply becomes a necessity and the Jubilee glow is, therefore, equipped with a pressure take-off point below the main bearing housing, into which an appropriate threaded nipple (supplied) can be screwed.

Construction is to the usual Super-Tigre high standards. All cast parts have a matt grey blasted finish, with cylinder head carburettor intake and prop driver in natural aluminium.

Specification

Type: Single cylinder, air-cooled, loop scavenged two-stroke cycle, glow-plug ignition. Crankshaft type rotary valve induction. Flat topped piston and central ignition plug. Optional pressurised fuel system.

Bore: 15 mm. (0.5905 in.). Stroke: 14 mm. (0.5512 in.).

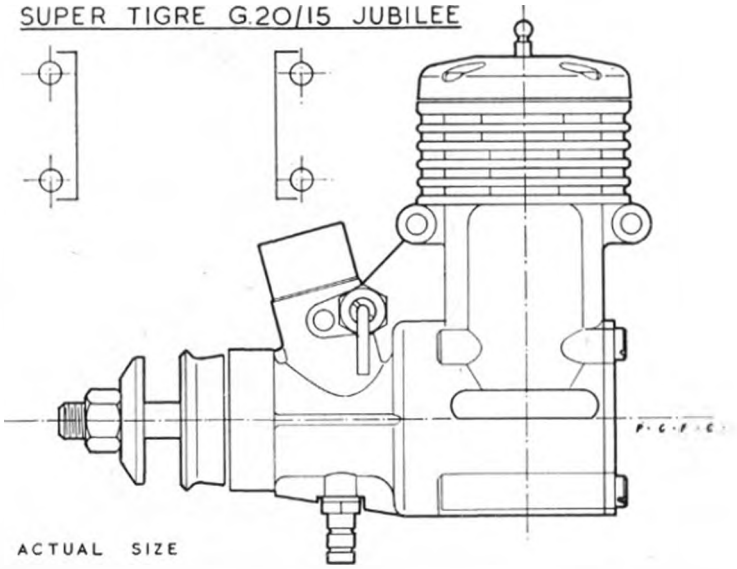
Swept Volume: 2.474 c.c. (0.151 cu. in.).

Stroke/Bore Ratio: 0.933 : 1.

Weight: 5.5 oz.

General Structural Data

Pressure diecast aluminium alloy crankcase/main bearing housing/cylinder block unit. Counterbalanced, hardened crankshaft with 5 mm. dia. hollow crankpin and supported in one 10 mm. i.d. rear and one 5 mm. i.d. front ball journal bearings with bronze bushing between. Non-hardened steel cylinder liner, push fit in cylinder block, located by flange at top. Machined alloy cylinder head with aluminium head gasket and secured with four short screws. Lapped cast-iron piston with fully-floating 4 mm. dia. tubular gudgeon-pin having brass eyelet type end-pads. Machined duralumin connecting-rod with plain, unbushed eyes and two lubrication holes at big end. Duralumin prop driver secured to shaft via dural split taper collet. Pressure diecast rear cover attached to crankcase with four screws and having central boss suitable for tapping for low pressure fuel system. Tapped boss below main bearing for high pressure fuel system. Interchangeable carburettor inserts for use with suction feed or pressure feed. Brass spraybar assembly. Beam mounting lugs.



Test Conditions

Running time prior to test: 2¼ hours. (First hour in short rich mixture runs not exceeding 1 min. duration.)

Fuels used: (i) 75 per cent. methanol and 25 per cent. Duckham's Racing Castor Oil. (Running-in and first dynamometer test.) (ii) 50/50 mixture of KK Record Super-Nitrex and Record Nitrex-70 (i.e., 50 per cent. nitromethane content and including 10 per cent. polyoxide lubricant).

Ignition plug used: Super-Tigre short reach 1.5 volt glow-plug as supplied.

Fuel system: Veco pressure tank used in conjunction with high pressure tapping and 8 mm. choke.

Air temperature: 72 deg. F.

Barometer: 29.75 in. Hg.

Performance

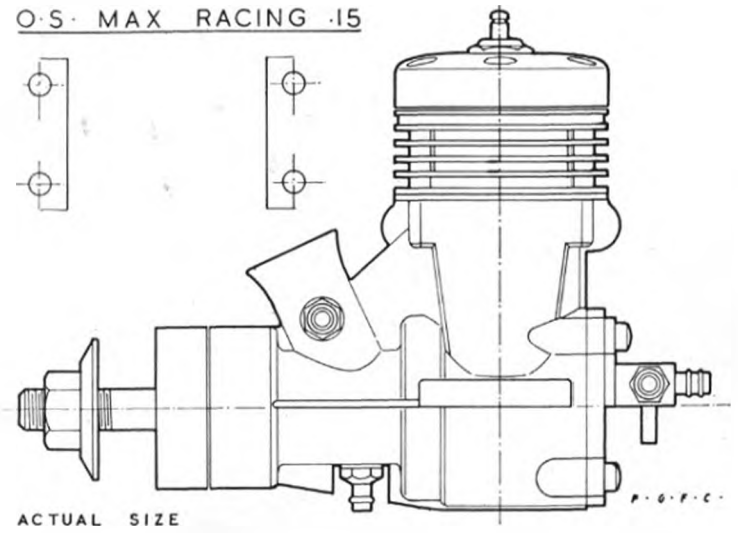
Starting procedure for the Super Tigre required generous priming both hot and cold to secure a quick start. When installing the spraybar with the "speed" venturi it is, of course, essential to make sure that it is so positioned that the jet hole is fully exposed, otherwise the engine will be starved of fuel. The lock-nut should be well tightened to eliminate any risk of the spraybar loosening and rotating.

We found that arriving at the optimum needle-valve setting was a trifle tricky on our particular example. The engine required wider settings as load was reduced but adjustment was not too per cent. progressive and since there is a slight delay in the engine's response to alterations in needle setting when running, great care had to be taken to ensure that the best setting had been reached before each fresh r.p.m. and torque reading was taken. However, this would not, of course, be of any great consequence to the average user who, having selected the prop size and fuel he wished to use, should have no difficulty in establishing the precise setting—with slight variations according to atmospheric conditions.

Having completed an adequate running-in period on the Super-Tigre and checked it on fuels of increasing nitromethane content, our dynamometer tests were commenced with a full test on a straight mixture of methanol and castor-oil as now required under F.A.I. 2.5 c.c. speed rules.

The Jubilee Tigre is, essentially, an engine which needs to be allowed to rev.—so much so that the torque (on straight fuel) developed at speeds below 9,000 was not much better than for a good 1.5 contest diesel. In contrast to most non-racing type motors, however, torque increased rapidly at five figure speeds and reached its maximum at no less than 15,000 r.p.m. where a figure of 22 oz. in. (equivalent b.m.e.p. 58 lb./

Super Tigre parts.



sq. in.) was reached. Torque then dropped off to result in a b.h.p. of 0.355 at 17,000.

The power increase obtainable on nitro fuel, however, is most marked. Again, power at the lower speeds is not impressive but on 50 per cent. nitromethane, our engine was pushed up to 28.5 oz. in. torque at 16,000 r.p.m. (nearly 75 lb./sq. in. b.m.e.p.) and a peak of no less than 0.495 b.h.p. at 18,200 r.p.m. In terms of prop speeds, the "Tigre, on this potent fuel, topped 16,500 r.p.m. on a Top Flite nylon 8 × 4 and 17,600 on a Top Flite wood 8 × 3½. Just on 20,000 r.p.m. were reached on a 7 × 4 Power prop.

Vibration was a little higher than the lowest levels we have encountered in the 2.5 c.c. glowplug engine class but running qualities were otherwise good.

On the basis of the performance of our test sample, it is clear that this latest G.20 is definitely one of the most powerful 2.5 c.c. motors available in the world today.

Power/Weight Ratio (as tested): 1.03 b.h.p./lb. (straight fuel). 1.43 b.h.p./lb. (50 per cent. nitro).

Specific Output (as tested): 143 b.h.p./litre (straight fuel). 195 b.h.p./litre (50 per cent. nitro).

O.S. Max Racing 15 2.48 c.c. Glowplug Engine

This impressive engine first appeared some 18 months ago, but, due to the O.S. company's manufacturing capacity being fully occupied in producing their existing range of engines, has only just reached the stage where regular production is getting under way.

Meanwhile, a few small batches of engines have been produced and six examples have, during the past three months, reached the U.K. Marking the first appearance of a Max Racing 15 in this country, George French used one of these to clearly top the British team selection trials for the 1961 World F/F Power Championships. After being the only competitor to score five maximums in the first round, he had only to make four flights in the second to be certain of top team placing.

The O.S. Max-D 15 Racing Glow (to give it its official factory title) is based on the crankcase unit of the somewhat less successful Max-D 15 diesel—hence the "Max-D" designation. The two engines are, however, totally unrelated as regards performance and handling qualities, the glow engine being vastly superior in every respect.

The O.S. Racing 15 is, of course, a twin-ball-bearing, shaft valve motor. The shaft has a diameter of 10.5 mm., which is the largest journal of any ball-bearing supported glow 2.5 shaft to date, and thereby permits the use of a 7.5 mm. (0.295 in.) gas passage and a generous valve port without risk of physically weakening the shaft. As on other recent high performance shaft valve glow engines, the valve port and bearing aperture have parallel sides to promote quick opening and closing of the induction cycle. Measured intake timing is 35 deg. ABDC to 45 deg. ATDC. Forward of the 10.5 mm. main journal, the shaft steps down to 6 mm. for the front ball-bearing and machined alloy drive hub. An unusual feature, the drive hub has eight 4 mm. dia. holes drilled in its rear face, half of which are lead filled to provide counterbalancing in addition to the normal counterbalanced shaft web. The rear face of the hub is then relieved to fit inside the front bearing housing to provide additional protection for the sealed front bearing. Both bearings, incidentally, are extremely smooth and free running.

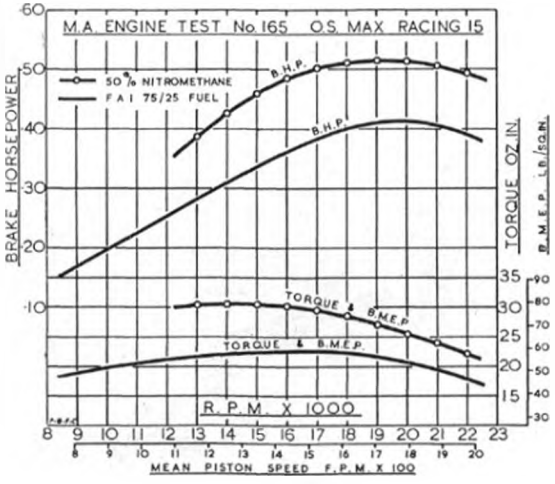
The finely finished cylinder is typically O.S. It has integral cooling fins and a pair of 4.5 mm. dia. skirt transfer ports which register with appropriately positioned ports in the piston skirt. An all-machined alloy head is used, having an offset plug position (transfer side) and a soft aluminium gasket. The piston is basically that of the standard Max-II 15 glow engine and has a filleted baffle and a 3.5 mm. gudgeon-pin with brass end pads. The piston skirt is relieved 0.001 in. below the gudgeon-pin.

The Max Racing 15 is intended for operation on pressure feed only. A shaft valve controlled pressure fitting is installed in the bottom of the bearing housing and no choke insert or spraybar is fitted, the venturi sectioned carburettor having a 9 mm. dia. throat into which a fixed jet is fitted on the left-hand side. The needle-valve is separately located at the rear of the engine and meters fuel to the jet via a short length of tubing. The complete needle-valve assembly is mounted on a triangular plate which is attached via the top two crankcase backplate screws and can be rotated to any convenient position. It could be mounted independently from the engine if more convenient.

Workmanship throughout is first class. Externally, the cast components (crankcase and backplate) have a dull satin tumbled finish, the cylinder fins, prop washer, head and back plate screws are blued and all other parts have a natural, machined or polished finish. Each engine is supplied with a rubber dust plug for the exhaust.

Specification

Type: Single-cylinder, air-cooled,



loop scavenged two-stroke cycle, glow-plug ignition. Crankshaft type rotary valve induction. Baffle piston and offset ignition plug. High pressure fuel system standard.

Bore: 0.598 in. Stroke: 0.539 in.

Swept Volume: 0.1514 cu. in. = 2.482 c.c.

Stroke/Bore Ratio: 0.901 : 1.

Weight: 5.85 oz.

General Structural Data

Pressure diecast aluminium alloy crankcase/main bearing housing unit. Counterbalanced, hardened crankshaft with 5 mm. dia. hollow crankpin and supported in one 10.5 mm. i.d. rear and one 6 mm. i.d. front ball journal bearings. Hardened steel cylinder with integral cooling fins. Machined aluminium alloy cylinder head attached with six Phillips screws, three extra long to secure complete cylinder assembly to crankcase. Lightweight innoculated cast-iron deflector piston, relieved below gudgeon-pin bosses. Fully floating hardened 3.5 mm. dia. gudgeon-pin with brass end pads. Machined aluminium alloy connecting rod with plain unbushed eyes and lubrication holes at both ends. Alloy, counterweighted prop driver secured to shaft via brass split taper collet. Pressure diecast aluminium alloy back cover attached to crankcase with four Phillips screws. Fuel pressure nipple fitted as standard below main bearing. Provision for alternative low pressure system via backplate fitting. Brass fuel metering valve assembly fitted at rear of engine, with gland nut to adjust needle grip. Beam mounting lugs.

Test Conditions

Running time prior to test: 3 hours. (First hour in short rich mixture runs not exceeding one minute duration.)

Fuels used: (i) 75 per cent. methanol and 25 per cent. Duckham's Racing Castor Oil. (Running-in and first dynamometer test.) (ii) 50/50 mixture of KK Record Super-Nitrex and Record Nitrex-70 (i.e. 50 per cent. nitromethane content and including 10 per cent. polyoxide lubricant).

Ignition plug used: KLG Miniglow (old type).

Fuel system: Veco pressure tank off standard rotary-valve tapping.

Air temperature: 70 deg. F.

Barometer: 29.95 in. Hg.

Performance

Starting qualities of the O.S. were among the best we have encountered in the 2.5 c.c. class. When the engine is cold, port priming brings it to life very quickly. When warm, the engine will usually start instantly, simply by flicking the prop. (Choking the intake is, of course, unnecessary and is, in fact, ineffective with a pressurised fuel system since fuel is automatically pumped to the carburettor as the engine is turned over. This ease of starting was maintained even on props down to 6 and 7 in. dia. allowing speeds in excess of 20,000 r.p.m.

The parts of the O.S. Max D-15.

The engine was found to run quite happily on a wide variety of props, ranging from 9,300 r.p.m. on a Tornado nylon 10 × 4 to 20,300 on a PAW 7 × 3, on straight 75/25 fuel. Subsequent torque tests on this fuel indicated, however, that maximum torque was not realised until some 16,000 r.p.m. were reached, torque dropping by about 15 per cent. at 10,000 r.p.m. Maximum power was reached at just on 20,000 r.p.m. where the very good figure of 0.41 b.h.p. was recorded, suggesting that this engine should be no mean performer as an F.A.I. class speed unit.

A very substantial improvement, however, was obtained on 50 per cent. nitromethane. Maximum torque jumped from 22.5 oz. in. to 30.5 oz. in. (80 lb./sq. in. b.m.e.p.) and 18,100 r.p.m. were obtained on a wood 8 × 4 Power-Prop. An 8 × 4 Top-Flite nylon was turned at 16,750 and 20,200 r.p.m. were obtained on a 7 × 4 Power-Prop. The 7 × 3 PAW was turned at 21,700 r.p.m. Maximum power on this fuel was realised at a slightly lower speed, approximately 19,500 r.p.m., although the peak was so flat that there was only about 3 per cent. drop in power at 2,000 r.p.m. either side of the peak. The actual power figure returned was no less than 0.515 b.h.p. which is the best we have yet obtained for a 2.5 c.c. motor and also gives the highest ever specific output recorded in this series—over 200 b.h.p./litre.

We were unable to fault running and handling characteristics (although we must add that one user has claimed that the counterweighted prop driver increases, rather than lessens, vibration *in a model*) and found the engine smooth and even running and very pleasant to handle. The needle-valve was easy and comfortable to adjust and the effortless manner in which the engine would hold a steady speed in excess of 20,000 r.p.m. was most impressive. The test engine has now accumulated about one hour's running at speeds of 17,000-22,000 r.p.m. and appears to be on the peak of its form, being extremely free running, yet with excellent piston seal both hot and cold.

Power/Weight Ratio (as tested): 1.12 b.h.p./lb. (straight fuel). 1.41 b.h.p./lb. (50 per cent. nitro).

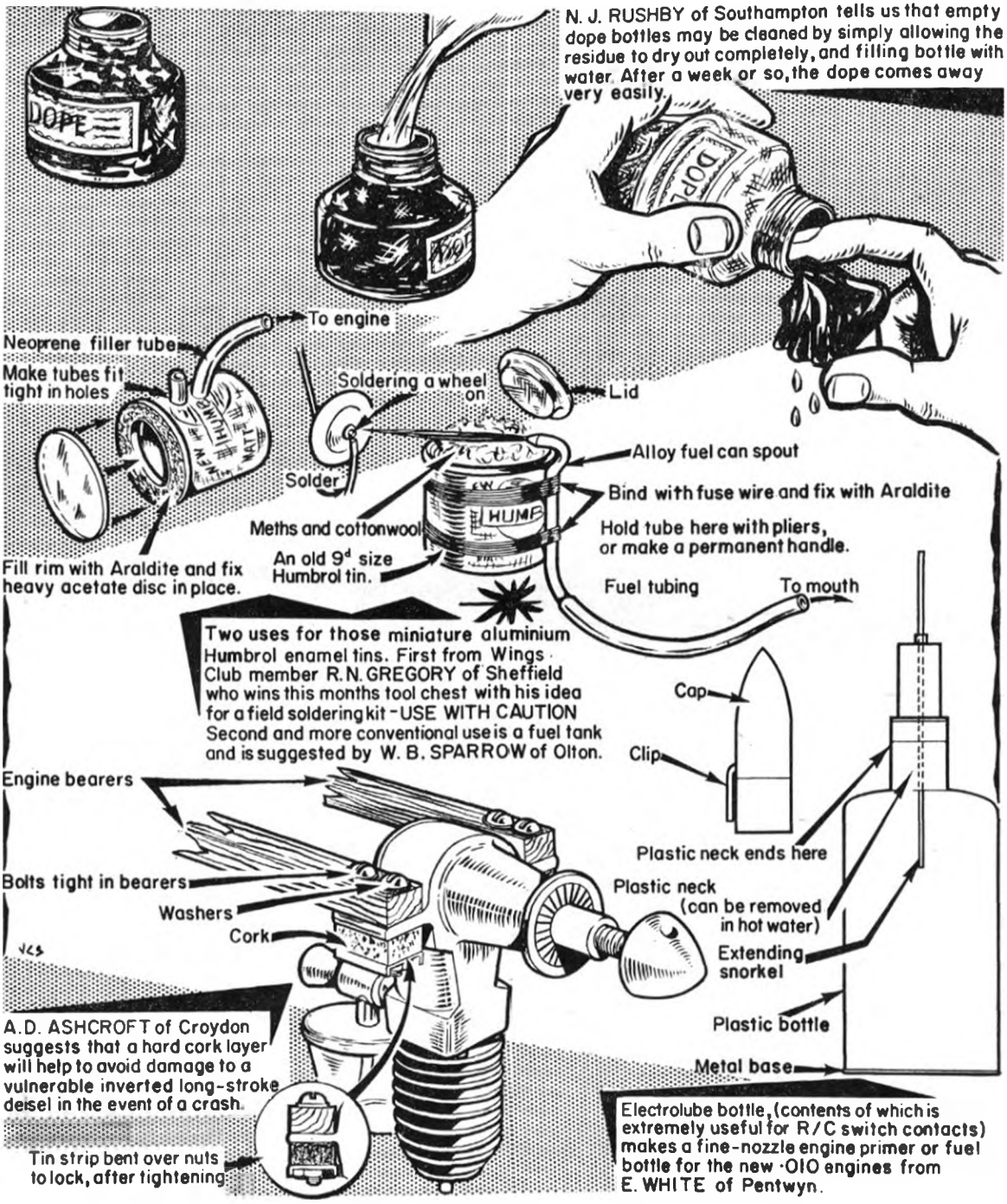
Specfic Output (as tested): 165 b.h.p./litre (straight fuel). 207.5 b.h.p./litre (50 per cent. nitro).

CONTEST CALENDAR

Aug.	27th	South Midland Area Gala, Cranfield, all classes.
,,	,,	I.R.C.M.S. Annual R/C Contest, Wellesbourne. Single, Multi and Scale.
Sept.	1-3rd	**WORLD CHAMPIONSHIPS, F/F.** Germany.
,,	3rd	Wanstead Combat Rally, Wanstead Flats. Classes "A" and "B." Pre-entry (2s. 6d.) by Aug. 27th to J. Franklin, 82, Grove Hill Road, South Woodford, Essex.
,,	10th	**NORTHERN GALA** GLIDER. U/R Glider. HAMLEY TROPHY. U/R Power. CATON TROPHY. U/R Rubber. RIPMAX TROPHY. R/C Rudder only. TEAM RACING. Class "½-A," "A" and "B."
,,	17th	†Croydon Gala, Chobham Common, R/G/P/½A.P.
,,	24th	*KEIL TROPHY U/R Team Power. Area.
,,	,,	FROG JUNIOR TROPHY. U/R Rubber/Glider. Area.
,,	,,	SPEED. Centralised.
,,	,,	South West R/C M.F.S. Rally, Dunkeswell, near Honiton, Devon. Single and Multi, 5s. entry fee pooled for prizes.
Oct.	1st	†South Coast Gala, R.A.F. West Malling, Kent. R/G/F/½A. P., F.A.I., T/R, R.C. Tailless, Combat.
,,	,,	Northern Area all F.A.I. C/L Meeting (Speed, Stunt, T/R), Rufforth.
,,	8th	"½-A" Power.
,,	,,	*FARROW SHIELD. U/R Team Rubber. Area.
,,	,,	TEAM RACING. Class "½-A" "A" and "B."
,,	15th	**AREA CHAMPIONSHIPS.**
,,	22nd	FROG SENIOR CUP. U/R Power. Decentralised.
,,	,,	CMA CUP. U/R Glider. Decentralised.
Nov.	5th	Wharfedale, 1,000 lap class "B" T/R, R.A.F. Rufforth.

†SMAE sanctioned contests.
SMAE events in capitals.
*Plugge Cup events.

Readers hints and tips . . .



CLUB NEWS

MARKET HARBOROUGH M.A.C.

The Northern Heights Gala was chosen as the venue for the annual outing. The weather was a disappointment, but we were not disheartened, various competitions were entered, and although the club wasn't placed, experience was gained, and members went home satisfied.

NOVOCASTRIA M.A.S.

Fifteen of our members made a 90-mile trek to Rufforth for the Wharfedale C/L Rally, which was very well organised, and entered in class F.A.I. and B T/R. Alan Wallace, whose models have been going well lately, put in the fastest heat time in F.A.I. T/R with 4.33, but could only manage 6.10 in the final to come in second after a series of mishaps. In class B Fred Bell put in our fastest time but was beaten, for the third time this year, by McNess of West Essex.

SCOTTISH A.A.

The Scottish C/L Nationals were held at Beveridge Park, Kirkcaldy, in wind and rain. Combat attracted the largest entry with 21, finishing with a hammer and tongs final between Badger of Prestwick and Hutton of Dunfermline for the new M.A.T.A. Cup, which was presented by Mr. F. Royle. F.A.I. team race (19 entries) was won by Young of Cadzow, second Lorimer, third Hill. Dumbarton got both first and second in class B and speeds ranged from 107 to 115 m.p.h. at 38 laps, first D. Gordon, second R. Rae. Poor support for stunt resulted in scrubbing the event and ½A team race attracted only eight entries.

YORK M.A.S.

In the Northern Area knockout, our junior and "A" teams were both defeated by Baildon juniors and Baildon "B" respectively; happily, York "B" beat Baildon "D." They now find themselves drawn against Baildon "C"!

The club has been invited to give a flying and static display at a local gala. Combat is a natural, but pity the cricket pitch!

LEICESTER M.A.C.

A combat match held at Derby started off with a club versus club comp., which Derby managed to win 4-3. In the knockout competition later we had 13 entries, the winner being Ken Deville of Derby, with Mick Tiernan and Gerald Mushett, both of Leicester, second and third.

The flying of both teams was very good, they were reasonably evenly matched, and they certainly kept each other on their toes. This made the competition quite exciting to watch, and at times was very amusing.

We would like to congratulate the organisers of the Combat at the Northern Heights Rally, who must have been saturated with the rain, but stuck to their jobs throughout what, to them, must have been a very dispiriting ordeal.

LEATHERHEAD D.M.F.C.

The fourth annual C/L precision contest was won by Keith Young with a Rivers 2.5 powered *Talon*. First, second and fourth places were taken by the Competition Sec., P.R.O. and Treasurer in that order. The Chairman and Secretary were the judges (fiddle!).

In the second round of the S.E. Area R.A.F.A. Shield, we managed a third in power (4 min. 40 sec.), and a fourth in rubber (4 min. 42 sec.).

BRIGHTON D.M.A.C.

A large contingent of members attended Barkston Heath for the F.A.I. F/F trials. John West, despite a poor fifth flight, was well placed in Glider and Ian Lucas finished ninth in Power.

ST. ALBANS M.A.C.

At the Northern Heights Gala members upheld their reputation for being all-weather fliers. Mick Burrows, who has been modelling for only two years, won the Queen Elizabeth Cup. Mick was soaked to the skin, but happy at this effort—which earned him a report and photograph in the local press. George Fuller was first in power, Bill Cleghorn second in glider and Tony Young second in ½A.

WINCHESTER M.A.S.

We must apologise to Dick Edmonds of High Wycombe, as the "gentleman," he mentions in his letter to MODEL AIRCRAFT, is one of our members. Actually this was a genuine mistake, as the "gent" was helping a combat entrant (from this club) to pack up his kit, and as our "pits" were situated by the control table, he seized the two tins of dope thinking that they were part of the equipment. This mistake was not realised until we were back in Winchester; and, until reading Dick's legitimate grumble, the rightful owner was still unknown. However, as dope cannot be sent by post, the value has now been refunded. We hope that peace may now exist, as we rate the High Wycombe C/L Rally as one of the best of the year, and we would like to thank all concerned in its organisation for a very enjoyable meeting.

JUNIOR LEADERS' REGT. R.E.

The C/L Rally held at Old Park Barracks, Dover, was a great success. The winners of the flying events were: *Combat*—1. Meekins Kenton; 2. Longley, Abingdon. *Stunt*—1. Oswell, Ashford; 2. Ruck, Rye; 3. Longley, Abingdon. *Team Race*—1. Trussler, Tunbridge Wells; 2. Weller, Ashford; 3. Collan, Isle of Thanet.

SOUTH SHIELDS M.A.C.

Formed a little over a year ago, we are expanding rapidly with the main interest C/L, although one or two members still refuse to be converted from F/F. At the last N.E. Area Rally the club made its presence felt by winning three first places—H. Carling, Combat; S. Barras, Stunt and D. Bennett, Glider.

NORWICH M.F.C.

Several members attended the East Anglian area meeting at R.A.F. Oakington, for the M.E. team glider and Flight Cup open rubber events. In the glider more down draughts were caught than thermals, but Barry Halford and Arthur Wharrie placed first and second for the area, with 10¼ min. and 9¼ min. in the Flight Cup.

HAYES & D.M.A.C.

First big outing since the Nats. was to Northern Heights, where we showed some of last year's form, but the weather didn't. Laurie Barr did a bit of slick retrieving to win the rubber event. Most of our entries were ruled out in a preliminary draw for Combat, but Ian Russell was left in, and went on to the final where he lost to Pete Tribe.

In the first round of the I.DICCC we met the Kentish Nomads, for the first time ever, and had a pleasant day at Chobham. The rubber and glider models were well matched, but the Nomads ran out of spare power models, to leave us with an easy win.

At the latest SMAE Speed meet (Wellesbourne) Hayes speedmen did 125, 124 and 116 m.p.h. in the Class 2, to place third, fourth and sixth. 29's are being given "the treatment" in an effort

RECENT RALLIES

Continued from page 284

coming from the right direction, was far too strong for the average model.

Time has made its mark on this contest, the modern R/C slope soarer taking the place of the conventional glider. This year 24 R/C pre-entries were received and outnumbered the entries in the Open, Nordic and Junior Classes. The flying in the R/C event was excellent and, despite the conditions, some very good results were obtained. The order of flight was made by draw and after fliers received their copies of the rules, they proceeded to attempt a 5-min. nominated flight, losing a point a second for times above and below the time. R. Donohue of Kersal, the eventual winner, put his scaled up *Hoverking* through manoeuvres usually associated with C/L stunt flying, his inside loops being perfect. A. L. Gwynn of Alderley Edge, flying a single channel *Aries* in his first competition, did an excellent second flight, but his rather poor first flight placed him ninth. The fliers from Kidderminster were placed second, third and fourth, a remarkable achievement produced by ample experience with single-channel controlled aircraft. Many future R/C fliers left the contest pondering over "multi" or "single" after seeing these models in action. During the day the down wind side of the hill became a mine of information, entrants giving details and comparing notes on R/C equipment.

Flying in the F/F classes was rather slow due to the conditions, but aeromodelling did not suffer as R/C flying collected some converts. A keen battle for the Gosling Trophy, which is awarded for the highest individual time, started early in the day between D. Barber of Southport and R. Oakley of Chester, who finished first and second respectively. A strong challenge was made later in the day by K. McClare of East Lancashire who won the Nordic class. A previous winner, J. O'Donnell, was seen to be observing the soaring of a seagull near the site, but was unable to produce results from his observations.

The contest concluded by the presentation of the Gosling Trophy and the traditional bronze medals to the class winners, by E. R. Seager, Chairman of the Chester M.F.C.

RESULTS

Gosling Trophy—D. Barber, Southport, 1 : 46. *Open*—D. Barber, Southport, 1 : 46. *Nordic*—K. McClare, East Lancashire, 1 : 31. *Junior*—M. Noble, Heswall, 1 : 25. *Radio*—1. R. Donahue, Kersall, 17 points; 2. J. Fellows, Kidderminster, 18 points.

to get over 140 m.p.h., while our Rossi *Vulcan* jet is still grounded, due to the lack of a suitable flying site.

BAILDON M.F.C.

Several members made the trip north to the P.A.A. Festival with some success, Henry Tubbs gaining second place in Power and Gerry Tideswell a lucky third place in Rubber, due to a competitor, who was also an organiser, being disqualified through neglecting to have P.A.A. printed on his wing!

For the Flight and M.E. Cups, the area had what we are coming to accept as normal—a 35 knot wind. Henry Tubbs managed 10.22 in the Flight Cup, eliminating two models in the process. We were the only club in the area to field two full teams for the M.E. Cup but times were low.

Interest seems to be swinging towards open power models, with Gerry Tideswell's new lightweight A.M.35 powered 380 sq. in. 13½ oz. model, and Tom Stoker's 400 sq. in. 14¼ oz. elliptical model with the new P.A.W.19D, which almost puts it into orbit on a K.K. 9 × 4.

HESWALL M.A.C.

At the Clywd Slope Soaring event M. Noble, flying his well finished *Lucifer*, placed first in the Junior event.

The recent news about silencers going into production brought cheers from B. Davies, as he will soon be able to fly his Merco 35 powered *Crusader* "without complaints," we hope! Who knows? If and when silencers are obtainable more stunt and combat models will be seen.

COSMO A.C.

The demonstration team put on a static exhibition at the Falconwood Community Centre and a flying show at Stone Parish Fete, both of which were highly successful. In the latter show the combat between our FW.190 and Mk. 14 *Spitfire* roused the crowd to such an extent that we would have been lynched if the 190 had won.

RECENT RESULTS

FLIGHT CUP

Unrestricted Rubber

1.	Holmes ..	Blackheath	12.00 + 2.51 = 14.51
2.	O'Donnell, J.	Whitefield	12.00 + 2.29 = 14.29
3.	Larrimore, L.	Portsmouth	12.00 + 2.14 = 14.14
4.	Barnes, J. ..	Liverpool	12.00
	Picken, B. ..	Wigan	12.00
6.	Boxall, F. ..	Brighton	11.44
7.	Halford, B. ..	Norwich	10.30
8.	Barr, L. ..	Hayes	10.20
9.	Poole, D. ..	Birmingham ..	10.18
10.	Tubbs, H. ..	Baildon	10.12
11.	Crossley, P. ..	Blackheath	9.54
12.	Latter, D. ..	Brighton	9.34
	Chadwick, J.	Ashton	9.34

39 *entries*, 10 *returned no score*.

MODEL ENGINEER CUP (Team Glider)

Individual results

1.	Simeons, C. ..	St. Albans	9.00 × 5.14 = 14.14
2.	Roche, D. ..	Anglia	9.00
3.	Knight, D. ..	St. Albans	8.36
4.	Willsmore, M.	Anglia	8.01
5.	Partridge, D.	Croydon	7.29
6.	Burrows ..	St. Albans	7.18
7.	Willis, N. ..	Essex	7.15
8.	Cook ..	Canterbury	7.08
9.	Woodhouse, M.	Norwich	6.51
10.	Oldfield, D. ..	Norwich	6.48
	Chadwick, J.	Ashton	6.48
12.	Mack, B. ..	Stevenage	6.46

117 *entries*, 10 *returned no score*.

Team Results

1.	St. Albans	31.29
2.	Anglia (A)	28.10
3.	Birmingham	24.25
4.	Essex	22.34
5.	Norwich	21.54
6.	Brighton (A)	21.18
7.	Canterbury P.	21.11
8.	Northern Heights	20.23
9.	Stevenage	19.50
10.	Ashton	19.05
11.	Brighton (B)	18.46
12.	Watford W.	18.23

These two models are shortly to be joined by a *Hurricane* and *Kittyhawk* built by Chris Wadlow and Aubrey Tick. These two boys, together with Steve Carter and Roy Memmott (all juniors), have formed the mainstay of our demonstration team this season. Who said juniors are not interested in flying? It's the other way round in this club.

We have seven entries in the Model Engineer Exhibition including two juniors of whom we have great hopes.

ANGLIA M.F.C.

At R.A.F. Oakington for the Model Engineer Cup, D. Roche scored three max's but was unable to return a fly-off time due to his model being lost on its last flight. M. Willsmore also did well by getting two max's, using his much repaired *Caprice*, but caught a down draught on his last flight. The total time put up by the team was 28.19 to place them top in the Area results and second nationally.

A number of the lads made the trip to the Northern Heights do, P. Davies getting through to the third round in combat, using his Oliver powered *Black Ghost*. The glider boys found out that the towlines have to be really strong to stand up to the F.A.I. pull test. Even so, they managed to turn in a few flights in between the showers.

CAMBRIDGE M.A.C.

Members were among the British modellers invited to enter contests at the U.S.A.F. Molesworth meeting. Club secretary Sue Allsopp came second in glider (*Empress*) while David (Dusty) Miller came first in Power (Cox Olympic/*Climax*), first in glider (*Caprice*) and second in chuck glider.

More recently Dusty produced an all-sheet trainer for an E.D. Bee, and set to work on the group of juniors waiting to be taught C/L flying. Result: in one evening we ran out of beginners; they can all fly now. So can a pair of interested spectators who have no connection with the club; they were lucky enough to be there at the right moment.

NORTHWOOD M.A.C.

Several members went to the Dover rally, which, with a little more support, could have been one of the best meetings of the year, numerous timekeepers being available and refreshments laid on.

Although our confidence in the weather for Halton was rather shattered, Pete Tribe went on to win the Combat event, keeping the Keil Cup in the "Northwood/Kenton family" for the fourth consecutive year.

CADZOW M.F.C.

We started off the first part of the 1961 season by doing quite well in F.A.I. Racing. At the Woodford Rally, the short-aspect-ratio *Dumbo* with Oliver was fourth and at the Nationals we were very successful!

Up north, in F.A.I., G. S. McPhail, and *Startiger*, was first, with C. Young third, at the PAA rally, while B. Parkes was, as usual, combat runner-up. At the Scottish Nationals, we collected first and second in racing and compatriots Badger and Co. were first in combat. These successes were exactly repeated at the West of Scotland Area Gala. There, the F.A.I. Comp. was run strictly to F.A.I. rules and it was evident that more practice is needed by most contestants.

WHARFEDALE M.A.C.

Thirteen members attended the Midland Area Rally where our most significant achievements were in the C/L events. Ray Hilyard placed fifth in Stunt, while the Ken Long/Lee Davy F.A.I. T/R team won the Class A event with the Nat's *Tigress VI*. Their best time was 4.36 in the second round.

The same team also took fourth place in Class B. During their heat the ETA 29 6 c.c. powered *Dalesman II* set a new unofficial British record for the five mile race, with a time of 3.08.

We would like to thank the Midland Area clubs associated with running the C/L events for a very well organised contest.

Four displays have recently been organised in connection with school fetes and gala days, while we have also received a request from a local A.T.C. Squadron for model instruction. In all cases additional entertainment in the form of lectures backed up with colour slides and cine shows was included to round off the evening. The interest thus stimulated will undoubtedly do much towards gaining our hobby more support from all sections of the public.

Forthcoming contests planned for R.A.F. Rufforth include ½A, F.A.I. and B T/R, Stunt and all classes of Speed at the Northern Gala on September 10th. Also a new "all F.A.I." meeting on October 1st will feature Stunt, F.A.I. T/R and international class Speed events. Last, but not least, November 5th is the date for the W'dale sponsored Rufforth 1,000 for S.M.A.E. class B T/Racers. Pre-entry (2s. 6d.) is essential for this event and should be sent to: Sec., DON HAWORTH, 38, Lidgett Park Avenue, Roundhay, Leeds 8, Yorks., to arrive not later than October 29th.

WALLASEY M.A.C.

After a year with continental type A.2's we feel that they have nothing to offer, as they seem to lose out on stability when compared with standard club designs. They are not so quick to build and so it is back to the old models, tip fins, etc.

At the first glider trials John Done placed second, losing one model and damaging another in the process. However, in a fortnight's furious building he has repaired the damage and built another A.2.

We were beaten into second place in the Model Engineer Cup by Ashton. With seconds to spare they managed a 2.00 min. flight, despite having the model spiral in on a previous attempt.

LEICESTER M.A.C.

With membership still rising, a system of control has been introduced on Braunstone Airfield for the regular Sunday afternoon flying, committee members being on duty on a rota basis.

Our Scale section is very active, and two trophies, one for F/F, and one for C/L scale models, were competed for recently. The winners were Tony Noble (C/L) and Ivan Birch (F/F).

The combat section went to Derby to do battle with the Derby Controliners, and a return match at Braunstone is arranged for the near future. Also 10 members entered combat at the Midland Area Rally, but were not able to get into the final; while five out of twelve entries in the concours event at this meeting were from Leicester.

Junior members are being encouraged by a special chuck glider competition, the prize being a Jetex motor and accessories donated by a member. They can enter any club competition, to gain points towards the Club Championship which is, at present, held by a junior member.

GLASGOW HORNETS M.A.C.

We have had a busy time recently, with four competitions in five weeks, one of which left us with our first ever contest win—G. Neill in combat at the P.A.A. Rally. The draw for the quarter-finals of this comp. made interesting reading, there being four Hornets lads against four lads from Ecurie Cadzow, this proportion being maintained through to the final. Our thanks go to the Cadzow boys, who ran the combat smoothly and to time. The week after the Pan Am, we made the trip to the Kirkcaldy M.A.C. Rally, where the wind dealt all too effectively with our models, our sole success being that G. McCree was one of the finalists in the ½A T/R final, which was not run off through lack of time.

A club rat-race, to Kirkcaldy M.A.C. rules, at our Giffnock flying ground, produced some pretty hectic flying. The winner was G. Neill, who flew 187 laps in 15 min., using an O/D flying wing with half the outside wing removed (after an "accident").

CRAWLEY M.A.C.

As a result of gale force winds at Chobham Common on Surbiton gala day, both Pete Cameron and Bill Horton lost their open power models, both were seen to D/T into the trees up by the cross roads, but as yet have not been found. They have now built 1½ scale *Dixielander-ish* designs as replacements. Using an O.S. 35 and ETA 29 for power, these models have an equally good climb and a slightly better glide, than Horton's original Veco 19 *Dixielander*.

Prior to this, Cameron and Horton were first and second respectively in open power, with their former models, at the first U.S.A.C. meeting at Goodwood this year. Pete Cameron also got first place in the first round of the R.A.F.A. Shield comp. at West Malling.

In the second round of the R.A.F.A. Shield Bill Horton was first in open glider using a

much battered *Caprice*, while Edgar Crumplin was third in rubber with his 10 year old Wakefield job, although he claims the rubber he was using to be of more recent vintage. At the same meeting our chairman, Don Plunkett, was testing his new A/2, when it hooked a king size thermal and was chased by car as far as Tunbridge Wells when it was lost in low cloud. He was fortunate enough to be contacted by a farmer the next day who saw the model land, in a field that had just been harvested, at 6.0 in the evening. The model was launched at 3 p.m. and the farm was 12 miles south of Tunbridge Wells, so the model flew a dog leg course of approximately 20 miles.

One of the local model shops has presented the club with a cup which will be for our junior members for open F/F, and is known as the Brookes Trophy. Also P. Cameron has donated a cup to our junior members; this is for C/L stunt flying, to a simplified stunt schedule.

S.E. AREA

The second round of the R.A.F.A. Shield was held at Ashdown Forest. Excellent weather made for an enjoyable day's flying and Tunbridge Wells increased their lead to 105 pts., while E. Grinstead, who improved to second place with 55 pts., were followed by Crawley, 50 pts., Medway, 35, Horsham, 15, Leatherhead, 10. Top scorers: *Glider*—W. Horton, Crawley, 7.38; R. Vincent, E. Grinstead, 7.21; J. Whitaker, Tunbridge Wells, 7.05. *Power*—R. Taylor, E. Grinstead, 5.33; W. Lovett, Medway, 4.58; R. Willes, Leatherhead, 4.40. *Rubber*—F. Puttock, Tunbridge Wells, 7.30; A. Paige, Tunbridge Wells, 7.20; E. Crumplin, Crawley, 6.42.

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PITCH and PROPELLERS for Rubber Models

Continued from page 282

extension of the methods described.

Having decided on the depth of the block—2 × 1 in. is a convenient size although the original Bilgri propellers used a 1⅛ or 1¼ in. deep block—the pitch and diameter must be selected and the pitch diagram drawn. On to this, superimpose the depth of the block to find what its width should be. Draw this in as a rectangle, with the pitch line diagonally across it. The centre 2 in. of the rectangle are the required part and, by noting where the vertical lines enclosing those 2 in. cross the diagonal, it is possible to mark out the tip end of the proposed blank (Fig. 4b).

The face of the blank may be marked by cutting an equilateral triangle from card, the base of which is equal to the width that the Bilgri block would be and the height equal to the radius of the propeller. By placing this on the face of the blank, overlapping equally at either side and with the point of the card at the centre of the propeller, the centre part of the X can be drawn (Fig. 4c). Where these lines come to the edges of the block, lines are drawn down the sides. Marking off can then proceed as in the diagram.

Those who have read Martin Presswell's recent article, or made a Bilgri propeller in the conventional way, will realise that the straight lines drawn on the side of the block should be slightly curved—the leading edge below the drawn line and the trailing edge above it. This could be drawn practically, by drawing pitch stations for every inch of blade, from the tip to the point where the taper starts, and joining the point with a flexible rule.

Carving follows the normal procedure with both these blocks. Carve and sand backs of blades flat between leading and trailing edge lines, then cut and carve undercamber if desired. Carve and sand fronts of blades as thin as experience and courage will allow. It is worth while carrying the flat back to within one, or even a half inch, of the root and then blending the back to the root rather abruptly. A useful hint when marking out the root on the end of the prop blank is to cement a piece of ply, cut to the width and depth of the hub, in position at the correct angle. It takes all the tricky work out of carving the root and assembling the blades to the hub.

This disposes of the simplest part of designing a propeller, the purely mechanical aspect. Next month I will deal with the far trickier problem of selecting a pitch and diameter which will give the required flying performance.

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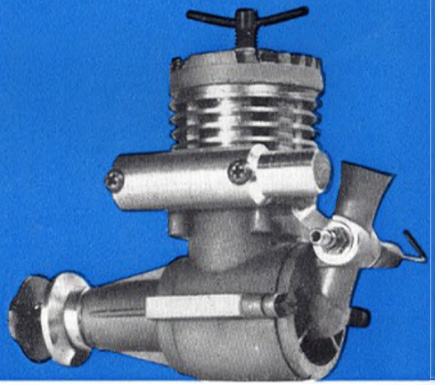

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