radio motor commentary

'SIXTY' ROUND UP

BY PETER CHINN

Carburettors

There is more variation in carburettor design among 10 c.c. R/C engines than in any other displacement group. Three basic types of carburettor are represented among the twelve engines with which we are dealing here.

These are: (a) barrel throttle with adjustable airbleed; (b) barrel throttle with fixed automatic fuel metering plus airbleed; and (c) barrel throttle with adjustable automatic fuel metering, with or without airbleed.

The first type is still the most popular throttle system for R/C engines (it is very widely used for small- and medium-size engines) and has the merit of simplicity. It is used by the Taipan, by certain Super-Tigre models and, up to the present, by O.S., although the latter is shortly to be offered with the option of an automatic fuel metering type, first on the shaft-valve 60F GP and later on the rear induction 60 GP.

The second system is used by the Enya 'Type G' carburettor fitted to the Enya 60-III TV. Here, fuel flows into the carburettor body and is metered to the jet by means of a stepped and tapered groove on the surface of the throttle barrel. As the throttle rotates to the closed position, fuel flow is thereby reduced to maintain an approximately correct mixture strength at all speeds. Since there is no means of adjusting the extent to which fuel flow is reduced and since excessive reduction would obviously cause the engine to cut out when throttled down, the groove is dimensioned to produce a slightly rich mixture and an adjustable airbleed is included to enable any excessive richness at low speeds to be corrected.

The third system, in various forms, is featured by the two HP's, the 'Micro-Flo' carburettor fitted to the Series III Merco 61, the Perry carburettor used on the current Veco 61, the Webra TN carburettor used on the Webra 61 and by the Super-Tigre 'Slider-Control' (used on our test model Super-Tigre G.60RV) and Mag-II carburettor.

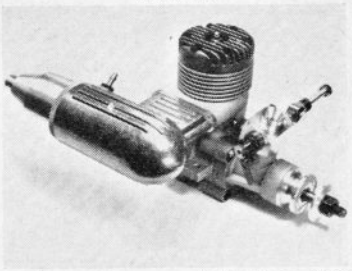
The mechanical means by which these carburettors achieve adjustable metering differs considerably but, theoretically, carburettors using this principle should offer improved throttle response and also give the opportunity of using larger choke areas which will release greater maximum power. This was the reasoning behind the development of the Merco Micro-Flo carburettor in which, as originally introduced two years ago, the effective choke area was approximately doubled to 42 sq. mm. by comparison with the orthodox airbleed type carburettor of the Series II engine and peak b.h.p., less silencer, was raised by about 30 per cent. (Since that time, the manufacturer has found it preferable, at a slight cost in top end power, to reduce the Micro-Flo's very large choke to more conservative proportions, in the interests of ease of adjustment by the user and this has, in fact, enabled the airbleed to be discarded.)

Effective Choke Area

The effective choke areas of the other eleven engines range from 20 sq. mm. (Super-Tigre) to 33 sq. mm. (HP 61), the average size being 26 sq. mm. It may, perhaps, be more than just a coincidence that the engines in the 26–33 sq. mm. group (Enya, HP, O.S. and Webra) developed the highest peak brake horsepower on test, while the 20–24 sq. mm. group were the least powerful. The G.60 Super-Tigres, potentially very powerful engines, did not place as high, on a peak b.h.p. basis, as one might expect and the fact that their choke areas were the smallest may be significant.

On the Taipan and both O.S. models, it is possible to adjust the choke area to give more power and less suction, or less power and more suction. On all three engines the complete jet assembly can be screwed in or out to reduce or increase the effective choke area

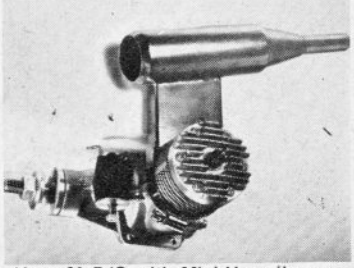
Webra Blackhead 61 R/C with Webra silencer.



and on the rear-induction O.S. 60GP, the choke also has a removable sleeve that can be withdrawn to increase choke area to as much as 48 sq. mm. It is extremely doubtful whether such a large choke would be practicable in an aerobatic model, although, having its carburettor so much closer to the tank than is the case with front induction, this engine, like other rear induction motors, will encounter less violent variation in fuel head and should, therefore, be able to tolerate a slightly bigger choke area, all other factors being equal. All three engines were, however, tested with chokes set up as supplied.

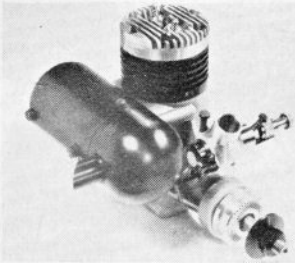
Porting

All except the HP 61 (rear bell valve), O.S. 60-GP (rear drum valve) and Super-Tigre G.60-RV (rear disc valve), have front induction via crankshaft rotary-valves and, as mentioned in Part I, all the shaft-valve engines, with the exception of the Merco, use 15 mm. dia. main journals, allowing large rectangular valve ports and 11 mm. dia. gas passages (the HP 61F passage is slightly smaller at 10.5 mm.). There is considerably less agreement among designers about valve timing. Generally, one might expect late valve closure to be reflected in slightly higher peaking speeds but other factors (choke area, cylinder port areas and timing, etc.) interevene here and it is clear that since individual designers have their own ideas as to which design para-



Veco 61 R/C with Mini-Vox silencer.

Merco 61 R/C Series III with Peak-Power silencer.



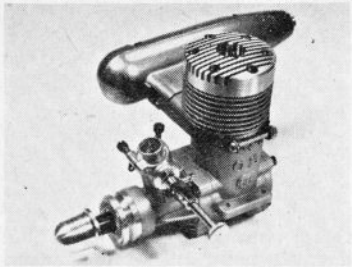
meters must remain inviolate and which are fair game for cut-and-try development, the chances of finding two engines with identical porting and port timing, are pretty remote. Incidentally, the transfer and exhaust periods given for the HP 61 are the average of three engines checked. These varied by 6 degrees of transfer period and 4 degrees of exhaust period.

Power

Except where otherwise noted, the performance figures quoted are the result of dynamometer tests using identical test procedures. It would be unrealistic to suggest that the figures quoted represent the *exact* capabilities of each and every production sample of a particular engine or even that they establish the precise order of merit, performance-wise of the twelve types. Anyone who follows, for example, the test reports published by the motoring magazines, will be well aware of the sometimes quite considerable variation in performance recorded for different examples of the same car and this applies in equal measure to model engines.

However, every effort has been made to obtain comparable results. All engines were supplied by manufacturers or distributors and were given similar running-in treatment. They were tested on a standard test fuel (5 per cent pure nitromethane, 25 per cent castor-oil and 70 per cent methanol) and with the maker's recommended glowplug. In the case of the HP 61F (for which only a pre-production model was available for test) and O.S. 60F GP (on which only provisional tests have been made to date) approximate figures are given. The Merco figures relate to the original Series III engine with earlier large bore Micro-Flo carburettor. The Super-Tigre ST.60 figures relate to a standard 2-ring engine with airbleed type Super-Tigre carburettor – not the latest 'SR' model with single Dykes ring piston and current Slider-Control or Mag-II type carburettor.

O.S. Max-H 60F GP with O.S. silencer.



Silencers

Most manufacturers of 10 c.c. R/C motors make silencers for their engines. The exceptions are the Taipan and Veco. We used a large-size (Model 103) Tatone 'Peace Pipe' for the Taipan, but the U.K. distributor is now able to offer a 'Spinaflo' silencer for this engine. We filed out the entry duct on the Peace-Pipe to suit the Taipan and discarded the optional rubber outlet restrictor, but the outlet area is still rather small for a 10 c.c. engine and it is possible that the Spinaflo might absorb less power. For the Veco we chose the German Min-Vox as this has been recommended by the engine's designer, Clarence Lee. At the time of testing the ST.60, a Super-Tigre silencer was not available and we therefore used a Swiss Koelliker expansion chamber type.

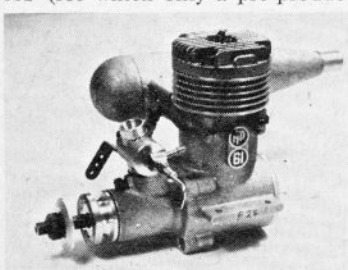
One thing is clear from the silencer tests and this is that the silencer outlet area has a major effect on the degree of power loss caused. By far the lowest power loss was that of the Mini-Vox, used on the Veco 61, which has a total outlet area of some 158 sq. mm. – more than three times that of the Super-Tigre S.71 expansion chamber. This silencer was also the least effective in reducing noise level. It is of an air-scavenged type, open at the front, but tests against orthodox expansion chambers with outlets enlarged to equivalent dimensions indicate that the scavenging effect is of secondary importance.

A reasonable outlet diameter for a plain, unbaffled expansion chamber type silencer for a 10 c.c. engine is 9 mm., giving an area of 64 sq. mm. This is the size of the Webra 61 expansion chamber outlet. It causes a slightly greater power loss (20 per cent) on the Blackhead 61 than on the previous, less powerful Webra 61 model. On the Enya, the expansion chamber terminates in a 10 mm. (78 sq. mm.) outlet (the previous Enya model had a 9 mm. outlet) and this causes a quite modest power loss (about 12 per cent) but the makers consider that the higher noise level will be unacceptable to many people and the silencer is, therefore, supplied with a screw-in, 8 mm. i.d. (51 sq. mm.) restrictor nozzle. This approximately doubles the power loss.

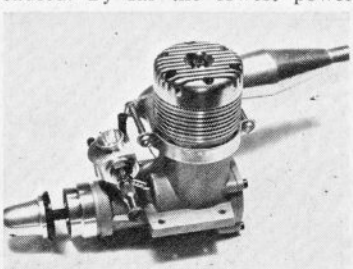
The O.S. silencer also has a 10 mm. dia. outlet but contains staggered half-baffles to reduce noise. Power loss with this silencer is of the order of 15 per cent. With its outlet nozzle removed, the O.S. silencer outlet area is increased to approximately 143 sq. mm. which, presumably, would release considerably more power (and noise) but no tests were made with the silencer in this condition.

The Merco Peak-Power silencer (71 sq. mm. outlet area) is basically an expansion chamber but with an internal outlet pick-up and offers a reasonable balance of power loss and silencing. The HP silencer has a 95 sq. mm. outlet area but is not excessively noisy due to the fact that a full-length slotted outlet tube is used to help break up the directional flow of the gases.

The Super-Tigre S.71 silencer has generously proportioned cooling fins which should be of practical help in cooling exhaust gases and thereby reducing their pressure (as well as helping to avoid engine overheating) but its outlet area is rather small. A new air-scavenged type ST silencer (on the Mini-Vox principle) is now available and should cause negli-

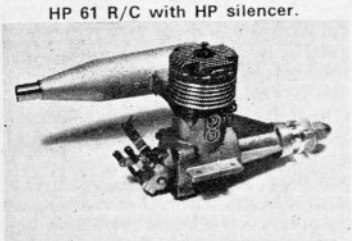


HP 61F R/C (pre-production) with HP silencer.



Taipan 61 R/C with Tatone Peace-Pipe silencer.

HP 61 R/C with HP silencer.



Enya 60-III TV with Enya silencer.

O.S. Max-H 60 GP (inverted) with O.S. silencer.

gible power loss – presumably at the cost of a substantial increase in noise level.

Prop revolutions with silencers

Not all the figures given in the table were obtained at the same time and, in a few cases, a different example of a given prop had to be used. They are, therefore, subject to variations of 100–200 r.p.m. but are an attempt to determine performances obtainable under normal operational conditions with silencers fitted.

The high low-speed torque of the Webra Blackhead and the HP 61F prototypes are reflected on the 14 x 6 prop and suggest that these engines should be well-suited to bulky scale models requiring a large diameter prop. At the other end of the scale, the figures on the 11 x 6 Top-Flite maple (which roughly represent the level in-flight r.p.m. on the popular 11 x 7 or 11 x 7½ sizes) give the edge to the rear induction HP 61, followed by the O.S.60 GP and HP 61F prototype. These three engines also emerge with the highest power/weight ratios.

Value

The average cost of an R/C 60, less silencer, is now £25 with purchase tax, but prices vary considerably. The cheapest is the Australian Taipan 61, at only £17 12s. 4d., which benefits from the fact that it enjoys Commonwealth Preference as regards import duty. A Mk. II version with improved performance is under development. The Supre-Tigre ST.60 – and, for that matter, the G.60F, are also good value but a weak point of all the Super-Tigre R/C engines, to date, has been their throttles, so that the substitution of another make of carburettor (often a Kavan) has become standard practice among contest flyers. This, of course, pushes the eventual cost up somewhat. However, the new Super-Tigre Mag-II carburettor (not yet tested on the 60s may be an alternative solution here.

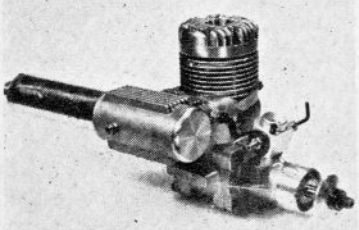
Despite a recent price increase, the Merco still costs less than most imported motors and is still excellent value. Fractionally cheaper, the new shaft-valve HP 61F could achieve the popularity that has eluded the very powerful rear induction HP 61. Much depends on how well the high promise of prototype units is confirmed by actual production engines.

In the medium price range, the Japanese engines, the Enya 60-III and both versions of the gold-head O.S.60 are well designed, soundly engineered motors with, perhaps, the edge in favour of the slightly more expensive and smoother running O.S., which also scores particularly well in regard to power/weight ratios.

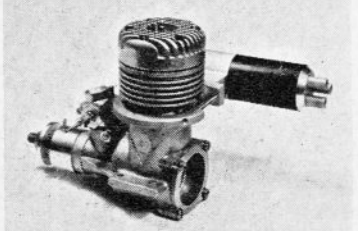
At the top end of the price bracket (£30–£35 less silencer) are the Super-Tigre G.60RV, Veco 61 and Webra Blackhead 61. Our G.60RV fell a little short of expected performance levels and power/weight ratios suffered as a result of its heaviness. (20.6 oz. with silencer as tested, 21 oz. with latest silencer) but should do a great deal better with the new air-scavenged type ST silencer and a better carburettor. The Veco, designed solely for American conditions, is improved on a higher nitro (10–15 per cent) fuel and, after consultation with designer Clarence Lee, ours was discovered to have a slightly below-par compression-ratio. The potential of the Veco is probably a good 10 per cent higher than our figures which, in view of the engine's modest weight, means a well above average power/weight ratio. The then-new Blackhead model Webra 61 impressed us a great deal when we tested two of them a year ago and it came as no surprise when this engine was subsequently used by the 1969 World R/C Championship winner. Unfortunately, a price increase, plus revaluation of the Deutschmark, means that the Webra is now the most expensive 10 c.c. R/C engine on the market, and price is undoubtedly a consideration with high performance R/C models where a crash can now totally destroy an engine.

Availability

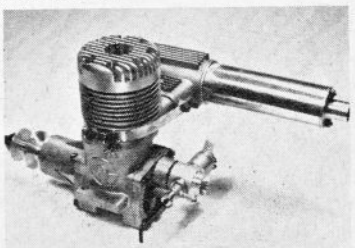
Since the first part of this article was compiled we have learned from the distributors that the first consignment of Enyas to be imported into the U.K. may be on sale by the time this article appears in print, but that the HP 61F will remain in short supply until later this summer. Demand for the Webra Blackhead and Gold Head O.S. 60s means that these are rather scarce at the moment but most of the others are obtainable from stock.



Super-Tigre G.60FI R/C with ST. S.71 silencer.



Super-Tigre ST.60 R/C with Koelliker silencer.



Super Tigre G.60 RV R/C with ST. S.71 silencer.

SIXTY ROUND-UP Table 2

	Enya 60-III-TV	HP 61 R/C	HP 61F R/C (Pre-production)	Merco 61-III R/C	O.S. Max-H 60 GP R/C	O.S. Max-H 60 F GP R/C	Super-Tigre ST.60 R/C	Super-Tigre G.60 FI R/C	Super-Tigre G.60 RV R/C	Taipan 61 R/C	Veco 61 R/C	Webra Blackhead 61 R/C
CARBURETTOR TYPE and method of mixture control	Enya Type G. Fixed automatic fuel metering and airbleed	HP with adjustable, automatic fuel metering	HP 2-needle. Adjustable, automatic fuel metering	Micro-Flo. Adjustable, automatic fuel metering	O.S. with adjustable airbleed Reversible (see text)	O.S. with adjustable airbleed (Auto type mid-1970)	Various (see text)	Various (see text)	Various (see text)	Taipan with adjustable airbleed	Perry. Adjustable automatic fuel metering	Webra 2-needle. Adjustable, automatic fuel metering
EFFECTIVE CHOKE AREA sq.mm. (approximate)	28	33	32	42 (see text)	30 (as tested) (adjustable 28–48)	27 (normal) (adjustable 25–32)	20–22	20–22	20–22	24 (normal) (adjustable 18–40)	23	26
ROTARY VALVE: opens	38° ABDC	40° ABDC	43° ABDC	40° ABDC	40° ABDC	45° ABDC	28° ABDC	25° ABDC	32° ABDC	44° ABDC	36° ABDC	30° ABDC
closes	53° ATDC	40° ATDC	47° ATDC	50° ATDC	40° ATDC	50° ATDC	60° ATDC	48° ATDC	56° ATDC	53° ATDC	44° ATDC	55° ATDC
TRANSFER PERIOD	114°	115°	108°	112°	111°	111°	122°	116°	116°	120°	114°	112°
EXHAUST PERIOD	132°	135°	128°	134°	135°	135°	140°	136°	136°	136°	138°	134°
GROSS BHP at R.P.M. (Independent Tests Less Silencer)	1·17 13,600	1·30 15,000	1·25 14,000/ 14,500 (Estimated)	1·14 14,400 (large choke)	1·27 14,600	1·20 14,000/ 14,500 (Estimated)	0·87 12,000	1·10 13,000	1·04 13,800	0·94 14,000	0·98 13,000	1·30 15,000
SPECIFIC OUTPUT BHP/Litre (Less Silencer)	117	131	126 (Estimated)	114 (large choke)	127	120 (Estimated)	87	110	104	94	98	130
POWER/WEIGHT RATIO (Less Silencer) BHP/LB	1·24	1·30	1·33 (Estimated)	1·20 (large choke)	1·37	1·32	1·03	1·07	0·93	1·02	1·11	1·32
RETAIL PRICE Inc. P.T.	£23.10.0d (less plug)	£24.0.0d (less plug)	£21.0.0d (less plug)	£21.14.6d (with plugs)	£25.5.10d (with plug)	£25.5.10d (with plug)	£17.14.0d (with plug)	£24.3.0d (with plug)	£30.0.0d (with plug)	£17.12.4d (with plug)	£33.0.0d (with plug)	£34.19.9d (with plug)
PRICE with RECOMMENDED SILENCER	£25 19.6d (less plug)	£26.9.6d (less plug)	£23.9.6d (less plug)	£24.15.5d (with plugs)	£27.7.11d (with plug)	£27.7.11d (with plug)	£21.0.0d (with plug)	£27.18.0d (with plug)	£33.15.0 (with plug)	See Text	£37.10.0d with Mini Vox (with plug)	£37.10.0d (with plug)
RECOMMENDED SILENCER	Enya	HP	HP	Merco Peak Power	O.S. 60/80	O.S. 60/80	Super-Tigre S.56	Super-Tigre S.71	Super-Tigre S.71	See Text	Mini Vox or Ko Venturi	Webra 1100/61-D
SILENCER TYPE used for Prop/ R.P.M. Tests	Enya * denotes nozzle removed	HP	HP	Merco Peak Power	O.S. 60/80 with nozzle ring	O.S. 60/80 with nozzle ring	Koelliker expansion chamber	Super-Tigre S.71 exp. chamber	Super-Tigre S.71 exp. chamber	Tatone Model 103	Mini Vox Air Scavenged	Webra 1100/61-D
OUTLET AREA OF TEST SILENCER sq.mm.	51 (78 – less outlet nozzle)	95	95	71	78 (143 – less nozzle-ring)	78 (143 – less nozzle-ring)	59	50	50	44	158	64
TYPICAL R.P.M. on TOP FLITE MAPLE PROPS WITH TEST SILENCER	14×6 8,300 *8,500	8,600	8,900	8,600	8,700	not tested	8,200	8,400	8,500	8,100	8 300	8,800
	12×6 10,300 *10,600	10,800	10,900	10,400	10,700	not tested	9,800	10,400	10,100	9,700	10,400	10,800
	11×7 11,000 *11,400	11,500	11,500	10,800	11,400	not tested	10,400	11,000	10,600	10 200	10,900	11,300
	11×6 11,700 *12,200	12,700	12,400	11,900	12,400	not tested	not tested	not tested	11,600	not tested	11,700	12,200
SPECIFIC OUTPUT BHP/LITRE with test silencer	90 *103	115	110	94 (with large choke)	108	104 (Estimated)	77	90	88	78	94	104
POWER/WEIGHT RATIO BHP/LB with test silencer	0·80 *0·92	0·98	1·00	0·86 (with large choke)	1·03	1·00 (Estimated)	0·74	0·76	0·68	0·75	0·88	0·91
UK DISTRIBUTION & SERVICE BY	Ripmax Ltd.	Ripmax Ltd.	Ripmax Ltd.	Mainstream Productions Ltd.	E. Keil & Co. Ltd.	E. Keil & Co. Ltd.	World Engines Ltd.	World Engines Ltd.	World Engines Ltd.	Model Aircraft (Bournemouth) Ltd.	Irvine Engines	Model Aircraft (Bourne-mouth) Ltd.