

Peter Chinn's

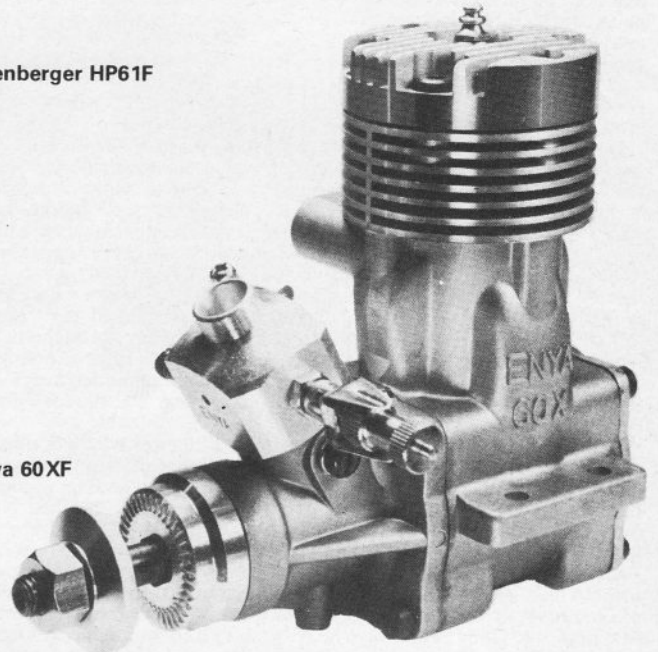
# RADIO MOTOR

## SIXTY SURVEY

# COMMENTARY



Left: Hirtenberger HP61F



Right: Enya 60XF

A TWO-PART article under the above title was published in R.C.M.&E. back in 1970. At that time there were approximately a dozen different .60 class (10 c.c.) R/C engines on the U.K. market. Today, seven years later, there are twice as many and most of these are entirely new models. Just a few of the earlier designs remain and all of these have been further developed and now appear in revised and improved versions.

Our earlier survey, which included data tables and sought to clarify the market situation for the benefit of prospective buyers, was well received and it is hoped that the present report will also be found useful both as a 'buyer's guide' and, in the case of engine enthusiasts, as a means of comparing engine specifications, etc.

All the 24 motors featured in this survey have been put through our standard test procedures. It excludes those which we have not personally tested, but these are, in fact, very few. The only significant omissions at the moment would appear to be the West German Proffi and the new Schnuerle scavenged front rotary-valve Rossi R.60-FI from Italy. The earlier crossflow scavenged rear disc valve Rossi 60 R/C has been tested (1972) since our earlier

survey, but this model is now out of production.

Because of its length, the data table is being split into two sections, the second of which will be published next month. Engines are arranged in alphabetical order so, this month, we have the first dozen, covering initial letters up to K. Most of the engines available to U.K. modellers are, of course, imported, the only British made 10 c.c. units being the well-established Merco 61 and the newer Meteor 60, both of which will appear in Part 2 next month. (There is a third British engine in the offing, the Red-shift 60, the prototype of which we described in R.C.M.&E. some months ago, but the production model is not quite ready for release at the time of writing).

Whether an engine is called a '60' or a '61' means little. For example, the  $24 \times 22$ mm bore and stroke used by Enya, O.S., Super-Tigre (all '60s') and Webra and Yamada (both '61') produces a swept volume of 9.953 c.c. or just over .607 cu. in., whereas the  $24.5 \times 21$ mm of

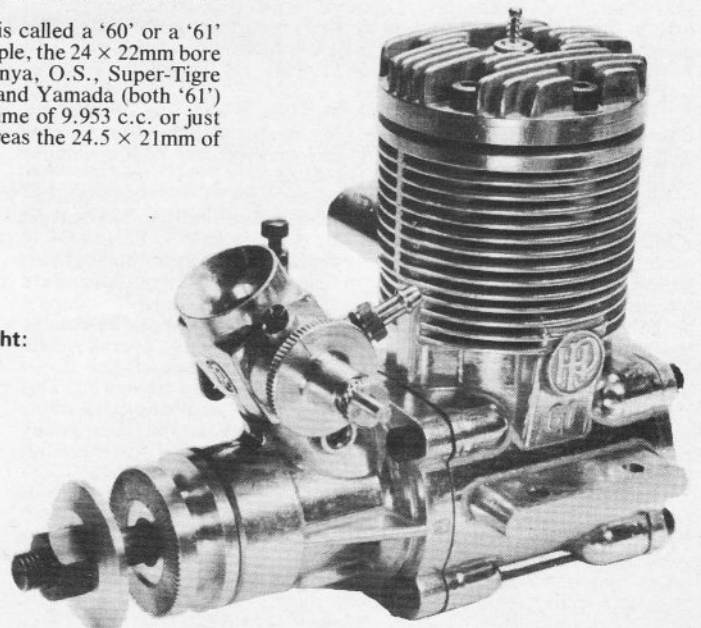
the HP 61 gives 9.900 c.c. which, at .604 cu. in., is nearer a '60'.

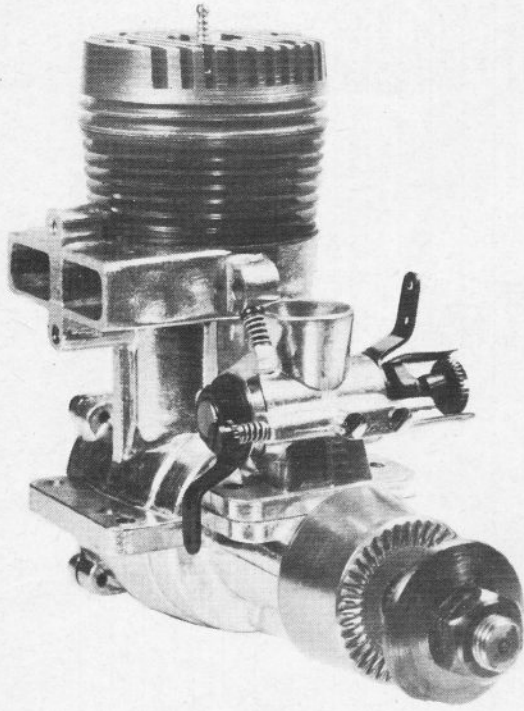
### General design trends

When our earlier survey was compiled, all but two of the engines featured were of the open-loop or crossflow scavenged type. The exceptions were the somewhat unorthodox Hirtenberger HP61, with its long shaft and rear bell-valve induction system, and the then brand-new development of it, the shaft-valve HP 61F, both of which featured Schnuerle scavenging. Today, about half of the 10 c.c. R/C engines on the market are Schnuerle scavenged or have porting systems which pro-

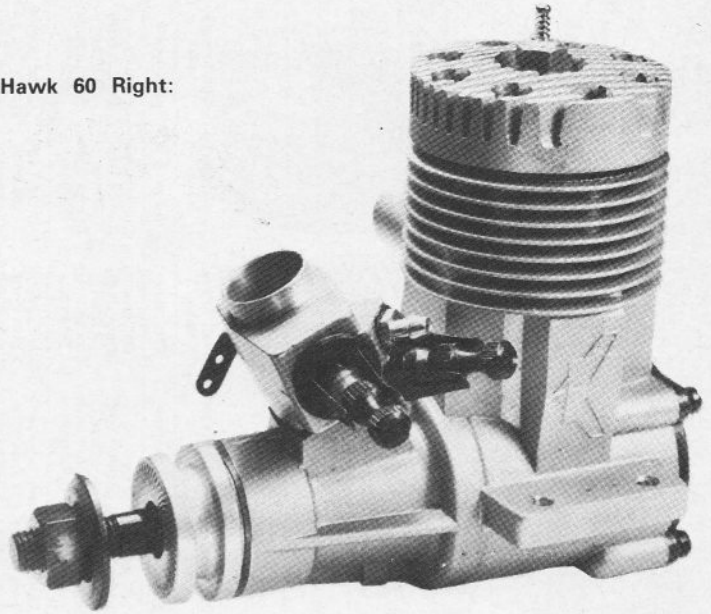


Left: Enya 60IIIB. Right: Hirtenberger HP61FS





Left: Fox Hawk 60 Right: Kraft 61



duce similar gas flow patterns and enable deflectorless pistons to be used.

Schnuerle porting systems have brought an all-round increase in performance. Better scavenging of exhaust gases from the cylinder and the resulting increase in the quantity of fresh gas introduced into the combustion chamber has resulted in higher brake mean effective pressures thereby increasing torque over the whole load speed range, so that these engines not only develop higher peak brake horsepower but also deliver more power when loaded down to full-throttle speeds well below the peak. This means, of course, that the rpm on larger props, as well as on 'normal' sizes, are increased. For example, on 12, 13 or even 14 inch diameters (such as might be needed to produce the static thrust necessary to lift a large and heavy scale model) rpm may be increased by between 500 and 1,000 compared with the levels reached by the previous generation of 10 c.c. R/C engines, while on the 11 inch diameters more widely used for high per-

formance aerobatic models, the increase may be as high as 1500 rpm.

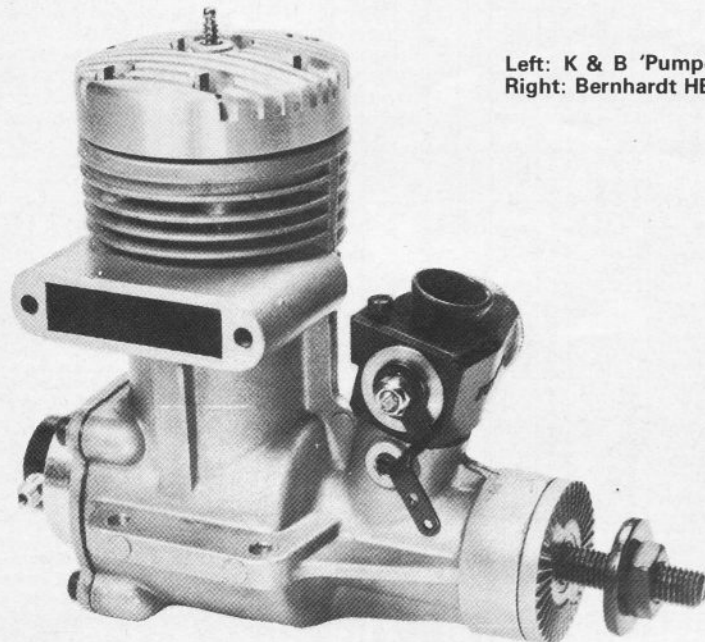
Schnuerle scavenging apart, another factor that has brought across-the-board power increases has been a substantial enlargement in carburettor effective choke areas. Back in 1968, the Merco Micro-Flo carburettor had pointed the way with a 42mm<sup>2</sup> choke area at a period when, for example, the Super-Tigre ST.60 and G.60 both had choke areas of only 20mm<sup>2</sup> but, by the time our first 'Sixty Round-Up' article appeared in 1970, Merco had opted for a slightly more conservative choke size and the average choke area used by the other eleven engines featured was 26mm<sup>2</sup>.

Today, the average choke size works out at around 36mm<sup>2</sup>. A figure of 30mm<sup>2</sup> appears to be the safe maximum with non-assisted suction feed, increasing to around 40mm<sup>2</sup> with low-pressure assisted delivery, i.e. when the now almost universal practice of employing exhaust gas pressure tapped from the silencer to pressurize the fuel tank is adopted. Even larger choke sizes are practical, however, if a

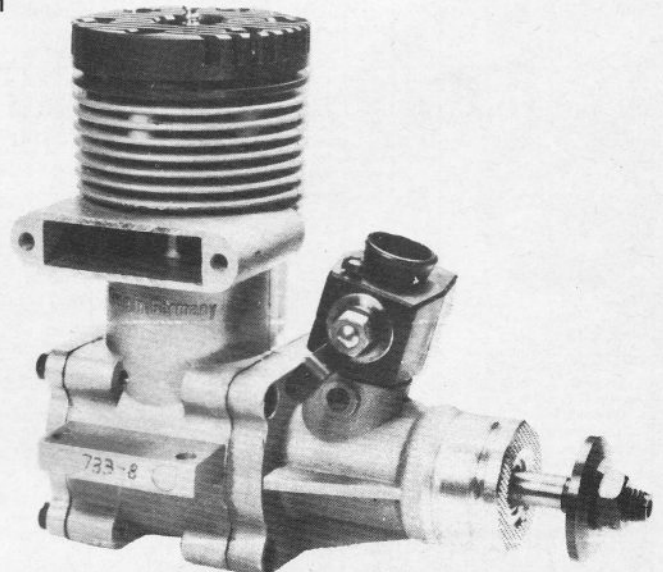
controlled high-pressure fuel delivery system is used. The best-known example of this is the 'Perry Pump' system in which the alternating positive and negative pressures within the crankcase are used to operate a diaphragm pump built into the crankcase backplate. Fuel is drawn from the fuel tank to the pump and, after passing through a pressure regulator section, is delivered to a special Perry pressure type carburettor having an effective choke area of some 60mm<sup>2</sup>.

Not only does this permit a worthwhile increase in power (for example, on the K&B 61, where it is available as a ready-installed factory option, it produces a peak bhp increase of approximately 10% compared with the standard Perry suction carb of 29mm<sup>2</sup> effective choke area), it also virtually isolates the carburettor from variations in fuel delivery pressure thereby maintaining the fuel/air mixture strength within combustible limits irrespective of tank position or model attitude in flight.

The Perry pump and pressure carb system can be purchased (at a cost of around £18) as a

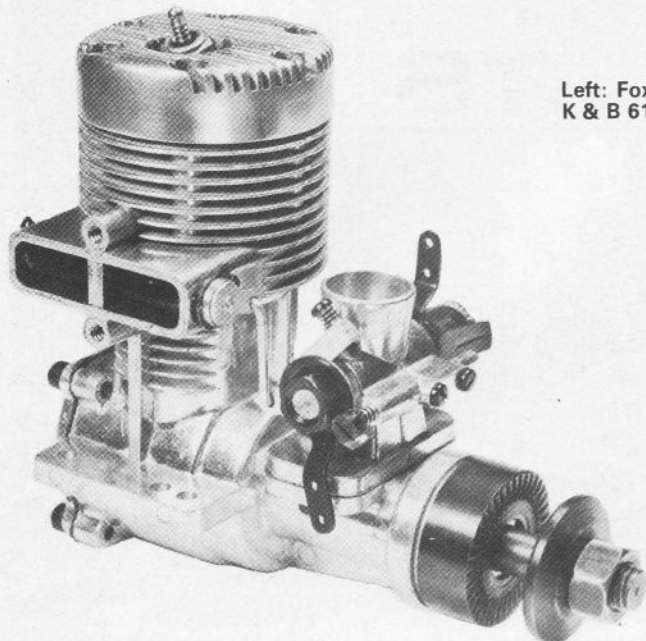


Left: K & B 'Pumper' 61 Right: Bernhardt HB61

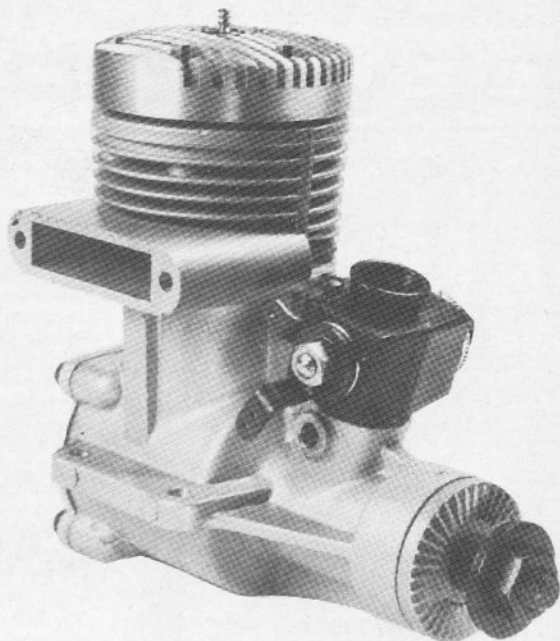


'SIXTY ROUND-UP' - TABLE 1

	BERNHARDT HB-61	ENYA 60-111B	ENYA 60-111B-G8	ENYA 60XF	FOX EAGLE 60	FOX HAWK 60	HIRTENBERGER HP-61F	HIRTENBERGER HP-61FS	K&B 'SERIES 75'	K&B 'PUMPER' 61 SER. 75	LEE CUSTOM 'PUMPER' 61	KRAFT 61
SWEPT VOLUME	c.c. cu. in.	9.953 0.6073	9.953 0.6073	9.953 0.6073	9.921 0.6054	9.921 0.6054	9.900 0.6041	9.900 0.6041	10.007 0.6107	10.007 0.6107	10.007 0.6107	9.951 0.6072
BORE	mm in.	24.0 0.9449	24.0 0.9449	24.0 0.9449	23.04 0.907	23.04 0.907	24.5 0.9646	24.5 0.9646	23.88 0.940	23.88 0.940	23.88 0.940	23.88 0.940
STROKE	mm in.	22.0 0.8661	22.0 0.8661	22.0 0.8661	23.80 0.937	23.80 0.937	21.0 0.8268	21.0 0.8268	22.35 0.880	22.35 0.880	22.35 0.880	22.22 0.875
WEIGHT less silencer with silencer	oz oz	14.6 18.0	14.5 17.8	17.1 20.6	15.1 18.0	15.1 18.0	14.9 17.5	16.9 19.8	14.1 18.3	15.1 19.3	15.1 19.0	17.0 19.6
LENGTH from prop driver face	mm	90	88	94	87	91	88	99	86	103	103	98.5
CRANKCASE WIDTH (bearing spacing)	mm	38	37	43	37	40	38	39	38.5	38.5	38.5	39
HEIGHT (CL to top cylinder head)	mm	80	76	80	77	80	78	77	79	79	79	77
WIDTH across mounting lugs	mm	60	62	62	57.5	57	55	60	55.5	55.5	55.5	61
INDUCTION SYSTEM		Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve	Shaft rotary valve
SCAVENGING SYSTEM		Crossflow	Crossflow	Schnuerle	Crossflow	Schnuerle	Schnuerle	Schnuerle	Crossflow	Crossflow	Crossflow & PDP	Schnuerle
BEARINGS - main - big-end - small-end		2 ball journal Bronze bush 6mm 6mm	2 ball journal Bronze bush 7mm 6.35mm	2 ball journal Bronze bush 7mm 6.35mm	2 ball journal Plain 6.35mm	2 ball journal Bronze bush 6.35mm Plain 6.35mm	2 ball journal Bronze bush 7mm 6mm	2 ball journal Bronze bush 7mm 6mm	2 ball journal Bronze bush 7.1mm 5.44mm	2 ball journal Bronze bush 7.1mm 5.44mm	2 ball journal Bronze bush 7.1mm 5.44mm	2 ball journal Bronze bush 6.35mm Bronze bush 6.35mm
PISTON		Aluminium with baffle, single Dykes ring	Alum. with baffle, 2 skirt ports, 1 ring	Alum. Flat crown, Ringless (in chromed alum. liner)	Alum. Flat crown, Single pinned ring	Alum. Flat crown, Single pinned ring	Alum. Flat crown, Single pinned ring	Alum. Flat crown, Single pinned ring	Alum. w/baffle, 2 skirt ports, bronze-bushed bosses, 1 ring	Alum. w/baffle, 2 skirt ports, bronze-bushed bosses, 1 ring	Alum. w/baffle, 2 skirt ports, bronze-bushed bosses, 1 ring	Alum. Domed crown, 3rd port window, Single pinned ring
CARBURETTOR - type and mixture control system		Perry-Adjust. auto. fuel metering	Enya 'G-8'. Fixed auto. fuel metering	Enya 'G-8'. Fixed auto. fuel metering	Fox, Separate idling jet auto. mid-range metering	Fox, Separate idling jet auto. mid-range metering	HP 2-needle. Adjustable auto. fuel metering	HP single- needle, Adjust. auto. fuel metering	Perry-Adjust. auto. fuel metering	Perry-Adjust. auto. fuel metering	Perry pressure type (AFM) fed by Perry pump/regulator	Kraft. Separate idling jet. Auto. mid- range metering
CARBURETTOR effective choke area (approx.)		29 sq. mm	44 sq. mm	44 sq. mm	30 sq. mm	26.5 sq. mm	37 sq. mm	37 sq. mm	29 sq. mm	60 sq. mm	60 sq. mm	36 sq. mm
ROTARY VALVE - opens - closes		42° ABDC 47° ATDC	39° ABDC 55° ATDC	35° ABDC 55° ATDC	38° ABDC 50° ATDC	47° ABDC 50° ATDC	37° ABDC 68° ATDC	37° ABDC 68° ATDC	40° ABDC 55° ATDC	40° ABDC 55° ATDC	40° ABDC 40° ATDC	31° ABDC 54° ATDC
EXHAUST PERIOD		134°	136°	136°	140°	150°	132°	146°	134°	134°	140°	147°
TRANSFER PERIOD		112°	120°	116°	110°	124°	116°	120°	114°	114°	112°	122°
THIRD PORT PERIOD		—	—	114°	—	128°	116°	110°	—	—	—	110°
BHP at rpm (less silencer)		1.14 at 14,000	1.20 at 14,000	1.32 at 14,500	1.13 at 12,500	1.45 at 15,000	1.30 at 15,500	1.54 at 15,500	1.30 at 14,000	1.43 at 14,500	1.58 at 15,500	1.52 at 15,500
BHP at rpm (with silencer)		1.08 at 13,200	0.92 at 12,000	1.15 at 13,200	1.10 at 12,400	1.40 at 14,400	1.14 at 14,500	1.32 at 15,000	1.11 at 13,200	1.26 at 14,000	1.50 at 15,000	1.32 at 13,500
TYPICAL PROP RPM (less silencer)	14 x 6 TOP-FLITE 12 x 6 TOP-FLITE 11 x 7 1/2 POWER-PROP 11 x 6 POWER-PROP	8,800 10,900 11,800 13,200	8,700 11,000 12,500 13,500	9,000 11,400 12,800 14,000	8,900 11,100 12,600 13,100	9,000 11,750 12,800 14,200	9,100 11,700 12,800 14,500	9,100 11,700 12,800 14,500	9,100 11,400 12,800 13,600	9,500 11,800 12,700 14,200	9,550 11,800 12,900 14,600	9,300 11,600 12,800 14,400
TEST FUEL - nitro content		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
SILENCER USED IN TESTS		HB open front	Enya exp. ch. w/ nozzle	Enya exp. ch. less nozzle	Fox 'C' type	Fox 'C' type	HP baffle tube type	HP expansion chamber	K&B/HB exp. chamber	K&B/HB exp. chamber	K&B/HB with 14.2mm tailpipe	Kraft exp. chamber
SILENCER - outlet area		142 sq. mm	50 sq. mm	78.5 sq. mm	168 sq. mm	168 sq. mm	95 sq. mm	87 sq. mm	60 sq. mm	60 sq. mm	158 sq. mm	130 sq. mm
SILENCER - noise suppression		Poor	Fairly good	Fair	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor
Year of mfr. of test unit		1973	1972	1972	1972	1974	1971	1976	1975	1975	1977	1975



Left: Fox Eagle 60 Right: K & B 61 Series 75



package to suit most of the leading front rotary-valve engines, the pump itself being ready installed in a replacement crankcase backplate and the carburettor spigot sized to fit the existing intake boss inside diameter. It is applicable to both crossflow scavenged and Schnuerle scavenged engines, but only of the front rotary-valve type.

Another Perry development is 'Perry Directional Porting', otherwise known as PDP. This is a simple modification to crossflow bafflepiston engines to improve scavenging. Consisting of the addition of a pair of narrow vertical slit type transfer ports angled through the cylinder wall between the exhaust and main transfer ports, it is available as an optional extra on the Bernhardt HB 61 (which then becomes known as the HB 61-PDP) and is also featured by the ringed-piston crossflow scavenged version of the Super-Tigre G.60-FI. In modified form it is combined with Super-Tigre's own porting system and deflectorless piston in the G.60-FI ABC model to produce a gas flow pattern very similar to Schnuerle scavenging. A good example of the benefits of combining both the Perry pump system and PDP porting is to be seen in the 'Lee Custom' modified version of the K&B 'Pumper' 61 which, further aided by the attentions of engine tuning expert Clarence Lee, with an increase in the exhaust period and general 'blueprinting', proved capable of equalling the performance of more modern Schnuerle scavenged designs.

Apart from performance, Schnuerle scavenging offers the advantages of somewhat more even heat dispersal through the piston and cylinder, resulting in cooler running and reduced thermal distortion and this is reflected in a general preference for Schnuerle scavenged engines for helicopter use. In general, the Schnuerle scavenged engines are a little heavier than the crossflow scavenged units but engine weights have not, on average, significantly increased since our earlier report. At that time, 10 c.c. engine weights had increased from the 12½-14 oz. weights of the earlier 60 R/C motors (such as the original Mk. I Merco 61 and Super-Tigre ST 60) to an average of around 15.3 oz. Our current batch of two strokes averages out at around 15.5 oz., the ST 60 and Merco 61 (both later versions of course) still being the lightest at 13.2 oz. and 13.7 oz. respectively and the Webra Speed 61R and OPS Ursus 60 the heaviest at around 18 oz. (All figures less silencers).

The popularity of the compact front rotary-valve layout shows no sign of diminishing. The three rear induction models listed in our 1970 survey are no longer produced and the sole rear rotary-valve model listed this time is the Webra Speed 61R. The adoption of the 15mm crankshaft o.d., permitting the use of a large bore (around 11mm) gas passage, was already well established at the time of our 1970 survey and the Merco remains the only shaft-valve engine using a smaller size (½ in. or 12.7mm).

It may well be, with the 15mm size now being used also for some high-performance .40 cu. in. engines, that the next stage in the development of front induction 60s will be towards even larger shaft journals. Such a move was, in fact, made a couple of years ago by O.S. when the front end of the 60FSR was redesigned to take a 16mm o.d. (11.7mm i.d.) shaft and, more recently, by the Rossi brothers who have adopted a 17mm (12mm i.d.) size for their powerful new R.60-FI. The forthcoming Redshift 60 also has a 12mm i.d. shaft.

**Data Tables**

The data contained in the tables being published in this and next month's issue relates to the actual motors examined and tested. A few of these engines have undergone minor modifications since the date of our original reports on them.

For example, in the interests of better noise reduction, the Bernhardt HB 61 is now supplied with a closed front expansion chamber silencer in place of the original vented front type supplied at the time of testing. This reduces the outlet area from 142mm<sup>2</sup> to 60 sq. mm and noise suppression can be regarded as 'fair' as distinct from the 'poor' rating given. (Naturally a somewhat greater power loss with this silencer must be expected).

Further notes on the tables will be contained in the concluding part of this survey to be published next month.

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12v Solder Iron .....	£3.20	6v Acc .....	£3.75	12v Acc .....	£11.95
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Bungee Parachute .....	£2.33	OS Exhausts Exten. ....	£2.00	Speed King .....	£22.95
Sullivan Starters .....	£26.00	Braided Bungee 30m .....	£5.40	<b>RADIO SPARES</b>	
Elec. Fuel Pump .....	£3.30	R/C Rapid Charger .....	£9.90	MacGregor .....	
Ammeters .....	£1.25	Dwyer Windmeter .....	£6.92	Ext. Lead .....	£1.40
Rotary Pump .....	£7.90	¼" Paxolin .....	45p	MR12R Servo .....	£15.00
Prop Balancer .....	£1.00	Flight Panel Inc. Pump .....	£13.95	MR12L Servo .....	£16.50
Retract T/wheel .....	£7.13	½ Scale Pilots .....	£2.20	Servo Tray .....	85p
Tacking Irons .....	£8.99	12v Acc .....	£11.95	Servo Arms .....	16p
2v Accs. from .....	£2.70	M.R. Pilots .....	34p	Servo Tray Single .....	36p
2v Charger .....	£5.70	12v Acc .....	£11.95	Buddy Lead .....	£1.80
Silicone Fuel Tube .....	15p	2v Varley .....	£6.50	Speed Controller .....	£26.00
per foot .....	15p	Speed King .....	£22.95	Also spare plugs, sockets, grommets, etc.	
Slec Fuel Pump .....	£1.92	D.B. Radio Primer .....	£2.00	Futaba .....	
Slec Fuel Pump fits .....		Radio Control Guide .....	£2.95	Rx 6 Ch. ....	£30.00
Gal Container .....	£2.79	Modelling the .....		Servo FD22M .....	£13.00
Kavan Starter .....	£27.20	Hurricane .....	£1.80	Servo FD17M .....	£18.50
Hand Pump .....	£5.95	Ripmax Handbook .....	95p		
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<b>RADIO SAILPLANES</b>		R/C Soaring .....	£2.75		
Releasable Towhook .....	£2.25				

Cox Muffler .....	£3.20	ZAP .....	£2.25
Merco 61 NVA .....	£1.92	Cyclone 15 .....	£4.45
Pins, 2 gross .....	£1.33	Valvespout .....	75p
8oz 5-min. .....		Throttle o/drive .....	72p
Epoxy .....	£2.99	Piviere .....	£27.56
Y Leads .....	£1.10	S-E 5A .....	£21.75
X-tals Pr .....	£3.60	Traveller .....	£33.50
Nicad Packs Rx .....	£8.00	Veron Impala .....	£10.61
Nicad Packs Tx .....	£15.00	Ext. Wing Kit .....	£4.11
FD16M Servos .....	£18.00	Big Impala .....	£17.30
FD21M Servos .....	£18.00	Magnum 40 .....	£17.50
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		Super Nova 100" .....	£18.50
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<b>AIRCRAFT KITS</b>		Capstan .....	£17.95
Slingsby Eagle .....	£14.95	MR Hurricane .....	£49.85
MR Hurricane .....	£49.85	Superfly .....	£24.95
Superfly .....	£24.95	Olympic 98" .....	£42.00
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Weston and JP Add on Silencers available

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Webra Speed 40 R/C .....	£49.90
Fuji 25 R/C .....	£22.95
Enya 40 TV .....	£37.70
Enya 29 4B TV .....	£24.75
Enya 29 IV .....	£24.60
Enya 45 III TV .....	£39.50
Enya 35 III TV .....	£25.60
HP 40F R/C .....	£39.50
HP 61F R/C .....	£42.00
Merco 35 R/C .....	£18.95
HB 20 R/C .....	£24.50
HB 25 R/C .....	£26.95
HB 40 R/C .....	£36.95
Cippolla 25 R/C .....	£172.00
Enya 60 R/C .....	£45.50

**RADIOS**

Macgregor IV .....	£138.00
Macgregor 3 .....	£69.95
Macgregor 2 .....	£58.00
Medallion .....	£63.00
Futaba 4 .....	£172.00
OS Cougar 4 .....	£148.90
S/H Sprengbrook Six .....	£58.00
Sanwa Speed Control .....	£130.00
Prices may be subject to change.	