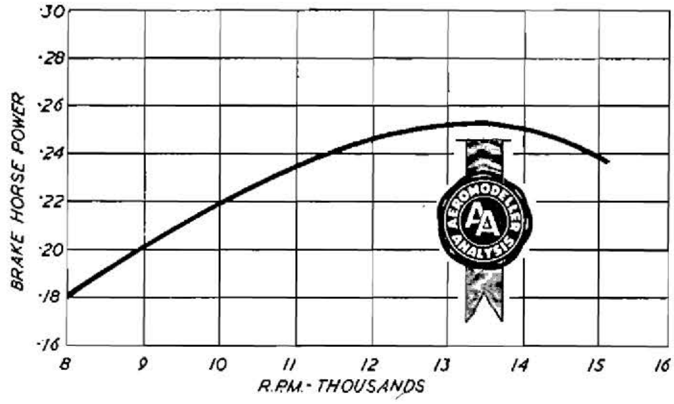
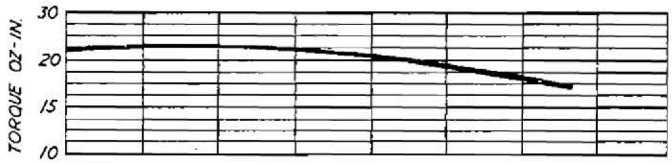
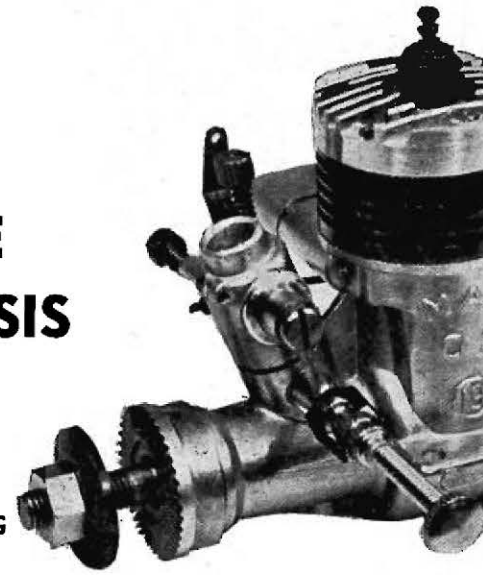




ENGINE ANALYSIS No. 123

BY

R. H. WARRING



OS MAX ·19 R/C

Excellent handling and throttle characteristics

DEVELOPED SPECIFICALLY as an R/C engine with the relatively complicated O.S. multi-speed throttle unit, the Max 19 R/C is a particularly compact power unit—appreciably smaller and half an ounce or so lighter than the American '19's' for example, with excellent handling qualities. Throttling characteristics are, in fact, every bit as good as those of the larger sizes of R/C glow engines, and better than any of the 19's we have previouusly handled. It also enjoys the distinction of more than 18 months continuous production without modification. Power output possibly suffers slightly as a consequence of the good throttle being fairly moderate for the swept volume, but figures were obtained on 'straight' glow fuel and could undoubtedly be improved upon using a more heavily nitrated fuel. Also the engine appeared still a little on the stiff side when test readings were taken, although well enough run-in to make the throttle fully effective. Extreme power is not all that important in an R/C engine of this size, and hence we were more concerned with general handling and behaviour, especially on economic fuel mixture and throttle response.

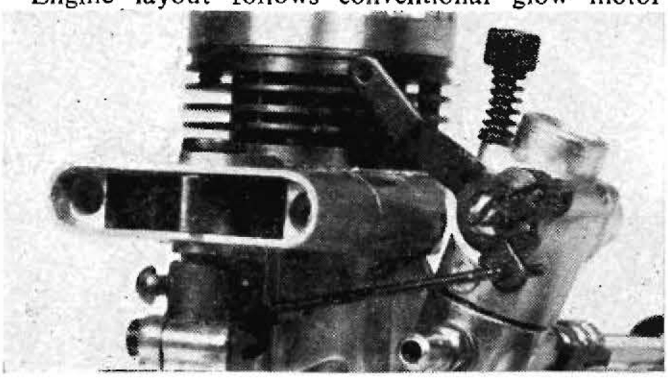
Peak power is developed within the range 13,000 to 13,500 r.p.m. although the Max 19 will run readily, and smoothly, at higher speeds with smaller props. Above about 12,000 r.p.m., however, 5 per cent nitromethane is highly desirable in the fuel for smoothing. The ideal R/C fuel would therefore appear to be a 70/25 methanol/castor mixture with 5 per cent nitromethane, although comparable results are obtained with a similar or slightly higher proportion of nitrobenzene (as used in Japan) and no nitromethane. The compression ratio of 9:1 is adequate for easy starting on straight fuel and glow plug type does not appear to be at all critical. The KLG 'Miniglow' (Quickstart EG 200) appears to suit admirably for throttled work O.S. themselves specify OS No. 3 plug for normal and OS No. 6 for R/C.

Engine layout follows conventional glow motor practice with a pressure die cast crankcase unit housing a mild steel cylinder held down by three long screws through the cast head. Three additional short screws assist in holding the head on to the cylinder. A large transfer passage is cast in on the left hand side of the crankcase unit with two rectangular exhaust ports on the opposite side opening into a stub exhaust. The cylinder has large rectangular transfer and exhaust ports cut in the lower walls, diametrically opposed and overlapping by approximately 75 per cent, together with two circular wall ports matching piston ports which are fully opened at the point of transfer opening. Transfer is thus effected both up the outside and through the cylinder wall into the transfer passage.

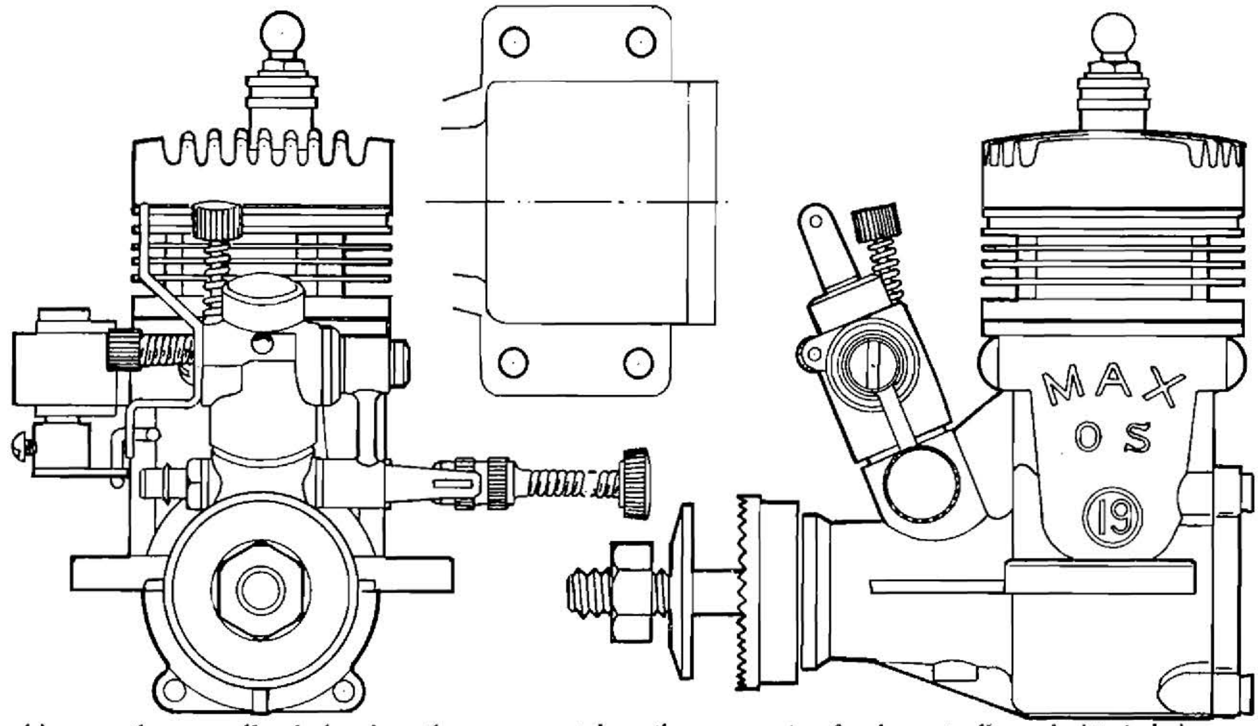
The piston is of conventional form, machined from a Meehanite casting, and with the upper diameter slightly relieved to a depth of about $\frac{1}{32}$ in. A normal flat deflector is incorporated in the head. The .153 in. diameter hollow gudgeon pin is of silver steel, fully floating and fitted with brass end pads. The connecting rod is machined from dural and of stepped section with plain big and little ends, the former having a drilled hole for lubrication. Piston and cylinder are finely finished and appear to have been lapped to fit.

The crankshaft is of nominal 10.5 m.m. diameter (.413 in.), stepping down to .2175 in. threaded length immediately in front of the bearing. The rectangular induction port is $\frac{7}{16}$ in. x $\frac{1}{4}$ in. opening into a $\frac{5}{16}$ in. central hole and giving some 180 deg. induction opening. Despite its large diameter the crankshaft is quite a light unit, weighing approximately $\frac{7}{8}$ oz., due to the fact that so much metal is cut away. The $\frac{7}{8}$ in. o/d crank web is shaped on the front face and heavily cut away for counterbalance. The .193 in. diameter crankpin is hollow. Actual journal length is quite short for an engine of this size—only 1 in. but the shaft appears adequately supported in a well finished bronze bush cast in with the crankcase and reamed and honed to size. The crankshaft is hardened and finished by centreless grinding over the journal length and crankpin.

Front length of the crankshaft immediately after the step is cut with a flat which locates and keys on the prop driver. This is a cast unit which is hollow on the back face with a counterweight segment. Although this type of driver has come to be favoured by O.S. we have some personal doubts that it is an entirely good idea to have a semi-hollow section



Close-up of O.S. Throttle as on 15 & 19 shows linkage to exhaust muffler bar and two adjusting screws for air bleed and slow speed.



backing up the propeller hub when the prop. nut is tightened as the driver could fail by cracking or splitting.

The cylinder head is of substantial thickness, formed as a pressure die casting and subsequently machined on the o/d and bottom face. A solid section some $\frac{3}{16}$ in. thick is surmounted by integral fins. The plug-in portion fitting the top of the cylinder is contoured to give a hemispherical combustion chamber but almost fully blanked off on the transfer side. The plug is offset to the transfer side, the element coming just above the inside of the deflector.

The throttle is a most complex affair, comprising a conventional barrel type throttle linked to an exhaust flap, but with an original fuel feed, and air bleed and throttle stop adjusted by separate screws. Fuel feed is via a pipe traversing the intake and carrying a conventional needle valve. Metered fuel supply is fed up to a jet tube mounted in the body of the carburettor and opening at the centre of the barrel. Feed to this top pipe is accomplished by a sort of banjo fitting which can be easily damaged by bending if the carburettor assembly is dismantled or assembled carelessly. It has been known to fail in flight. Both tube assemblies seal on fibre washers and are best left strictly alone, and *not taken apart* just to see how many individual parts are involved (actually nearly 30 in the complete assembly).

The barrel valve itself is of brass, free to rotate but effectively locked in the carburettor body. In addition to the main passage (giving a fully open bore for full throttle position) there is a second hole in the barrel connecting to an air bleed hole in the body, the opening of which is controlled by a screw with a coil spring lock. This separate hole comes into effect immediately the throttle starts to close, the amount of air actually admitted being controlled by the setting of the adjustment screw. The other screw merely controls the amount of barrel rotation—i.e., acts as a stop for setting the slow running position.

Barrel rotation is controlled by an external lever which is attached to the barrel by a single screw. A wire link from the bottom of this lever connects to a pivoted exhaust flap in the stub exhaust extension so that barrel (throttle) and exhaust flap are closed or opened simultaneously. The result is most effective throttling and the system can be adjusted very accurately. The only shortcomings we noticed were purely mechanical ones — the screw holding the throttle lever to the barrel can vibrate loose and so can the grub screw attaching the link arm to the exhaust flap pivot.

Adjustment needs a little care to get best results, but is not difficult. Initial adjustment should be made with a slightly rich setting on the needle valve with the throttle fully open. The slow running position can then be found temporarily by adjusting the stop screw, and adjusting the needle, if necessary, to maintain consistent running. If the needle *does* have to be adjusted, however, this means that the air bleed is not correctly set. The trick is then to adjust this screw for more or less air when slow running, depending on whether the needle had to be screwed in or out, respectively, to keep running. With a little trial and error, the needle valve can be returned to its original position (slightly rich on full throttle setting), and slow running smoothed entirely by the air bleed adjustment.

Correctly adjusted, really consistent slow speed running of the order of 2,000 to 2,500 r.p.m. can be obtained from an open throttle r.p.m. of 10-12,000,

Propeller — R.P.M. Figures

Frog nylon	8 x 6	10,300
	10 x 6	7,900
	9 x 6	10,100
K-K nylon	9 x 4	11,900
	8 x 6	11,000
	10 x 4	9,400
Top Flite nylon	10 x $3\frac{1}{2}$	9,500
	9 x 4	11,200
	9 x 6	9,100
	8 x 6	10,800
	8 x 4	13,800

Fuel: 75/25 methanol castor plus 5 per cent nitrobenzene.

Specification

Displacement: 3.159 c.c. (.193 cu. in.).

Bore: .6535 in. (16.5 m.m. nominal).

Stroke: .575 in. (14.5 m.m. nominal).

Bare weight: $5\frac{1}{4}$ oz.

Max. power: .254 B.H.P. at 13,300 r.p.m.

Max. torque: 22.5 oz.-in. at 9,500 r.p.m.

Power rating: .0805 B.H.P. per c.c.

Power/weight ratio: .043 B.H.P. per oz.

Material specification:

Crankcase: pressure die cast light alloy incorporating lower cylinder and stub exhaust.

Cylinder: mild steel, turned with integral fins, blued.

Piston: cast iron.

Connecting rod: dural (machined).

Cylinder head: light alloy pressure die casting.

Crankshaft: hardened steel.

Gudgeon pin: hollow silver steel.

Back cover: light alloy pressure die casting.

OS .19 R/C Analysis (continued from page 297)

with immediate pick-up on opening the throttle and a good range of intermediate speeds. For bench running, slow speeds of 2,000 r.p.m. can be maintained with fully effective throttle response, but for flight work it would be better to aim at little higher — say 2,500 to 3,000 r.p.m. In practice, this means that having established correct adjustment for minimum speed running of 2,000-2,500 r.p.m. the throttle stop screw can be adjusted to give a slightly faster idling speed with some advantage. Re-check, however, that the air bleed adjustment is the best possible with the new stop setting, and that the full throttle setting is *slightly* on the rich side.

The O.S. throttle appears to approach very closely the ideal for a glow engine. Flexible throttling action is provided by the combined barrel throttle and exhaust flap, whilst the air bleed adjustment provides more than enough adjustment to establish an 'optimum' mixture for slow running as well as 'compensating' the mixture over a range of lower speeds. Correctly set up the engine neither tends to starve or flood when idling for a lengthy period, as is often apparent with glow motor throttles. This, in turn, also means that the demands from the glow plug are less critical for throttled operation and a plug with an idling bar is not necessary (although the O.S. No. 6 is a shielded type). A good test of a throttle is to set it for optimum low speed running and continue running at low speeds for some time, or until the engine eventually stops with fuel still in the tank. If the throttle is not completely balanced (or properly adjusted) the engine will either stop 'dry' or 'wet'. In the case of the O.S. it does neither.

Another feature which impressed with the O.S. 19 was the high quality of the workmanship. All of the castings are superb, the detail design is excellent and the machining and general finishing of the highest order. In these respects the O.S. is not just comparable with, but better than, most contemporary R/C glow motors of similar size.

We would recommend any aeromodeller to fit a locking washer under the screw holding the throttle lever in place, and also make sure that the exhaust flap lever grubscrew is tightened down on to a flat on the flap spindle. Logical propeller size for any R/C model would be 9 x 4 or 10 x 3 ; or possibly a 9 x 5 for a fast flying model. An extra facility is of course the 'Jetstream' silencer type S which fits the 19 easily and is reasonably effective.