For a ball race engine the "Byra" proved quite stiff and needed an appreciable amount of running-in time to free properly. Starting and general handling characteristics are excellent, the contra piston holding its setting at high speeds without working back (a fault found with the larger engine) and with little falling off in power as the engine warmed up. Mercury No. 8 fuel appeared to suit the engine very well.

Constructionally, the Byra features a gravity die-cast crankcase unit carrying two ball races to support the shaft, and a conventional screwed-in cylinder. The cylinder is of substantial wall thickness, the four transfer ports being formed on the inside. These are a little unusual in being quite wide and terminating under the exhaust ports, *i.e.*, not corresponding to the "pillar" positions in the exhaust flange. Both the cylinder and piston are of hardened steel, which is again different from conventional practice where a soft rubbing surface is usually used against a hard one.

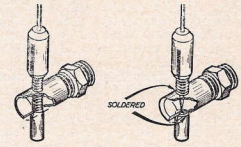
The connecting rod is a relatively crude casting (or possibly a rough forging), but more than generous in size. Piston fit is generally excellent; also the fit of the mild steel contra piston. The cylinder jacket follows orthodox practice in being turned from dural and is anodised black. The quality of the anodising is somewhat higher than that usually found on contemporary British engines.

The hardened steel crankshaft has a diameter of 6 mm. (·236 in.) reducing to 5 mm. (·197 in.) at the front. The crankshaft thread is 4·5 mm. metric size. The propeller hub fitting screwing on to the crankshaft is of steel, the depth of thread cut on the inside being inadequate and as a consequence the threads are easily stripped.

In general, however, the workmanship throughout is high, considerable care having been taken with regards to fits and alignment.

Being a symmetrical engine (provided the rear cover is rotated 120 degrees in changing the direction of running), performance is virtually the same in either direction. R.p.m. figures for clockwise running cannot be given since these would necessitate a set of opposite-hand propellers, but torque output figures were similar for similar speeds. Hand starting (for a right-handed person) with clockwise rotation and a small propeller is a little hazardous for after all this is a racing type engine! Performance is somewhat higher than the 1·5 c.c. plain bearing engines.

Standard spray bar and modified carb. for Byra which provided comparison figures as below



Propeller R.P.M. Figures		Propeller R.P.M. Figures with Modified Carb.	
Propeller dia. x pitch	*r.p.m.*	*Propeller dia. x pitch*	*r.p.m.*
8 x 5 (Stant)	9,500	8 x 5 (Stant)	8,200
8 x 4 (Stant)	10,400	8 x 4 (Stant)	9,500
7 x 8 (Stant)	10,300	7 x 6 (Stant)	9,900
7 x 4 (Stant)	11,500	7 x 4 (Stant)	11,200
6 x 4 (Stant)	13,600	6 x 4 (Stant)	14,200
6 x 4 (Frog nylon)	16,000	6 x 4 (Frog nylon)	16,000

Fuel used: Mercury No. 8

THE BYRA WAS subsequently re-tested with a new "straight through" carburettor unit (*see* diagrams) which appreciably modified the performance. Performance was similar at about 11,000 r.p.m., fell off as compared with the original at lower speeds, but gave better results at all higher speeds up to 16,000 r.p.m. The approximate equivalent power curve is plotted on the main graph as a dotted line, where it will be seen that the peak is pushed up to the ·12 B.H.P. mark and occurs at 14,000 r.p.m.—some 2,000 r.p.m. up on the original figure.

DATA

Bore: ·494 in.
Stroke: ·455 in.
Displacement: 1·43 c.c. (·087 cu. in.)
Bore/stroke ratio: 1·085
Weight: 3¼ ounces
Max. B.H.P.: ·114 at 12,000 r.p.m.
Max. torque: 11·4 ounce-inches at 8,500 r.p.m.
Power rating: ·08 B.H.P. per c.c.
Power/weight ratio: ·0314 B.H.P. per ounce

Material specification:
Crankcase: light alloy gravity die casting
Cylinder: hardened steel (D-3)
Piston: hardened steel
Contra piston: mild steel
Crankshaft: hardened steel (A-4
Crankshaft: hardened steel (A-4)
Connecting rod: light alloy
Main bearings: two ball races
Cylinder jacket: light alloy (anodised black)
Rotor disc: aluminium

Manufacturers: F. Batllo, Barcelona, Spain *Price:* 515 Pesetas

From Germany,

Webra 1·7cc

THE 1·7 C.C. WEBRA is a strange design in some ways. The integral exhaust stack is on the left (port) side of the engine, or diametrically opposite to the theoretical optimum position for anti-clockwise rotation. This exhaust stack, too, continues in the form of a collector ring right round the cylinder and the cylinder exhaust ports themselves are diametrically opposite and at an angle of some 45 degrees to the axis of the engine. As a consequence, whichever way the cylinder is assembled (and there are only two alternative positions, 180 degrees apart) one exhaust port faces forwards and into the exhaust stack and the other backwards and into the collector wing, whence this exhaust has to escape round the ring into the stack. This has the effect of giving a "four-stroke" noise superimposed on the normal exhaust note at certain speeds when the engine is running on minimum lean mixture.

Another unusual feature is that the steel cylinder is not hardened, possibly because this would have made the thin integral fins too brittle. This unit has, however, been particularly well machined, even to the rounding off of the edges of the individual fins.

Care must be taken in screwing down the two holding bolts not to distort the cylinder. The two exhaust ports

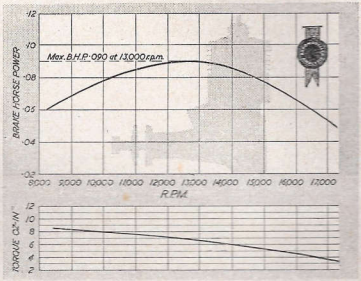
cut in the cylinder wall are of generous size. Two transfer ports are cut inside the bore up between the exhaust ports with an appreciable overlap. Sufficient metal then remains for a "clear-run" for the gudgeon pin up and down the cylinder so that there is no chance of it getting trapped in either an exhaust or transfer port.

The piston is of cast iron, flat topped and light in construction. The connecting rod is machined from steel and remarkably slender with ball-shaped ends. Obviously adequate for the job, it appears to have been influenced by American technique.

The crankcase casting is relatively complex (as a production job) with a space between the intake tube and the cylinder base. If it is to keep the pipe cool by reducing heat transfer from the cylinder, then it fails in its object since it is virtually impossible to choke the engine without touching the very hot collector ring.

The hardened steel crankshaft is 7 mm. (·276 in.) diameter drilled at the front end and threaded (internally) 4 mm. metric for the hub screw. This hole is taken well back down the shaft to lighten, the port opening hole from the other end terminating at the port itself. This is a good feature in that it avoids a "dead" gas space in a hollow crankshaft drilled past the port but still achieves approximately the same degree of weight saving. The crank web is circular (unbalanced) and machined to a saucer-shaped section, presumably to lighten. The crank pin is 4·1 mm. (·161 in.) diameter. Crankcase volume is quite small with bare clearance for the big end.

Starting characteristics are good with the needle opened one turn or more beyond the normal running setting, one or two finger chokes then being adequate to prime. Once the engine is "wet" it continues to run as soon as it fires, when adjustment can be taken up on the needle valve, as necessary. With the smaller propeller sizes there is a noticeable "kick" when starting which calls for a smart flick in order to avoid a backfire and a smart rap on the finger. It was, however, an engine which could be approached with confidence for starting on any propeller size. Running was quite consistent at all speeds, but somewhat happier at the upper end where tests were pushed up to some 16,000 r.p.m. plus. Mercury No. 7 was a satisfactory fuel, but good running was also achieved on a lower nitrate fuel. A K.L.G. glow plug gave equally good results, possibly slightly better, than the original German plug—a rather neat



affair in brass. The latter burnt out after some thirty minutes running time.

PROPELLER R.P.M. DATA

Propeller dia. – pitch	*r.p.m.*
8 x 5 (Stant)	7,800
8 x 4 (Stant)	9,000
7 x 4 (Stant)	10,800
7 x 3 (Stant)	11,600
6 x 4 (Stant)	12,200
6 x 3 (Trucut)	13,000
6 x 3 (American)	14,300
6 x 4 (Frog nylon)	14,500

Fuel used: Mercury No. 7. A fine pitch propeller would appear best for this engine, to give a static r.p.m. figure of 11,000 to 12,000.

DATA

Displacement: 1·745 c.c. (·1064 cu. in.)
Bore: ·513 in.
Stroke: ·515 in.
Bore/stroke ratio: 1·0
Weight: 2½ ounces
Max. B.H.P.: ·090 at 13,000 r.p.m.
Max. torque: 8·5 ounce-inches at 8,500 r.p.m.
Power rating: ·0515 B.H.P. per c.c.
Power/weight ratio: ·036 B.H.P. per ounce

Material Specification:
Crankcase: light alloy pressure die casting
Cylinder: soft steel
Piston: cast iron
Cylinder head: dural
Crankshaft: hardened steel (journal length 1·03 in.)
Bearing: plain (reamed and lightly honed)
Con. rod: steel (turned)
Manufacturers: Fein und Modell technik, Genestrasse 5, Berlin-Schoneberg-Germany.