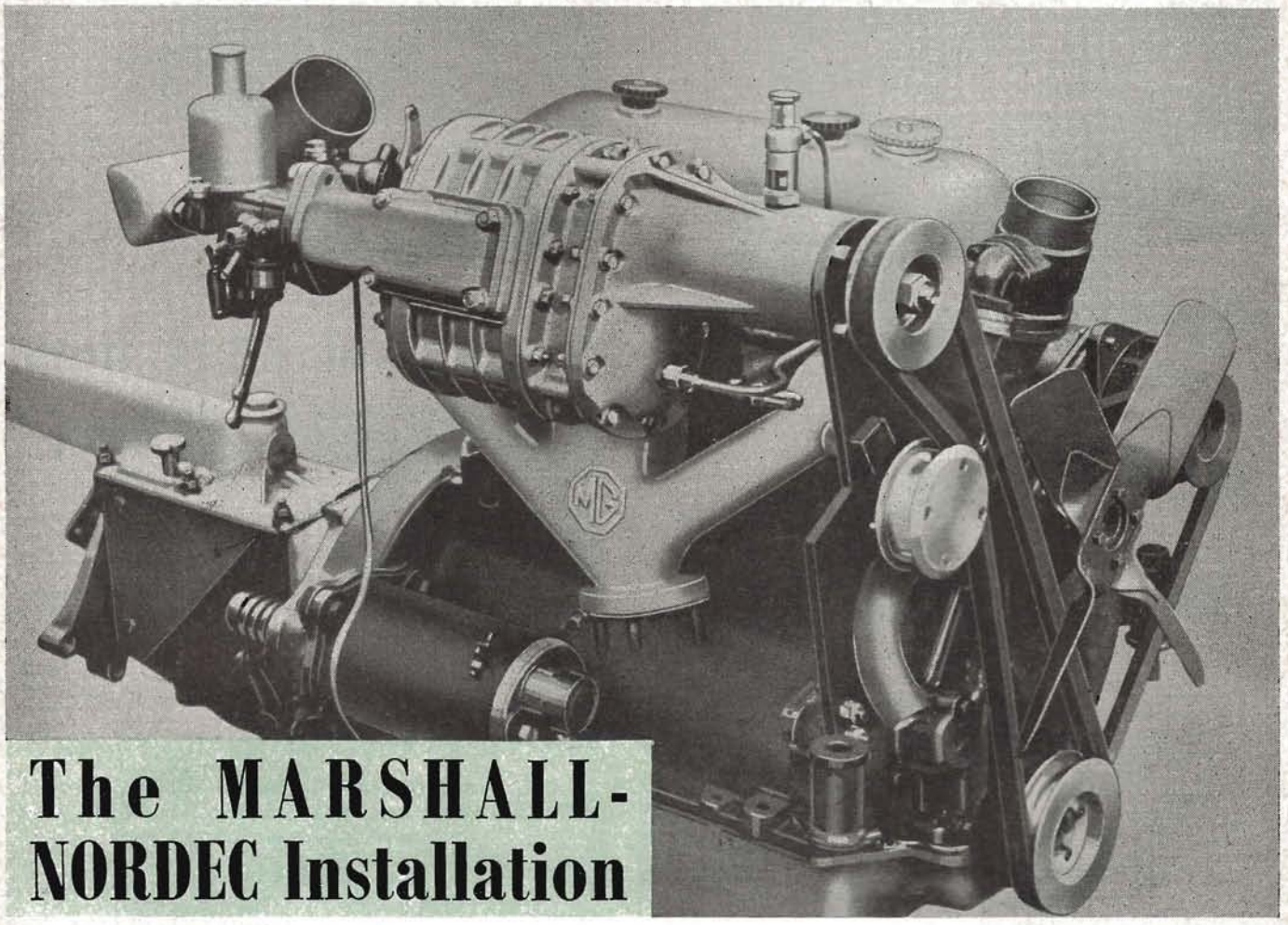
Third of a series of articles dealing with various equipment for

SUPERCHARGING M.G. "XPAG" POWER UNITS



The MARSHALL-NORDEC Installation

by W. E. BLOWER

With acknowledgements to North Downs Engineering Co.

THE Marshall Roots-type compressor is manufactured by Sir George Godfrey and Partners Ltd. and is supplied by the North Downs Engineering Co. Ltd., Caterham, Surrey, England, complete with installation kits suitable for use with the M.G. "TA", "TB", "TC" and "TD" Midgets and Series "Y" one and a quarter litre Saloon. The design of the installation is such that it can be fitted by the average mechanically-minded owner equipped with a modest tool kit, and it is supplied complete to the last nut and bolt, including fitting instructions and installation drawings.

For the 1250 c.c. engine a compressor having a nominal displacement of 75 cubic feet of free air per minute at a speed of 3,000 r.p.m. is used and this unit is designated as type J.75. There are four light alloy main castings; a rotor case, finned for heat dissipation and additional strength; two end plates, also finned, and the nose-piece. Machined to fine limits, the end plates house at one end a pair of ball bearings which take the journal loading and which locate the rotor shafts endwise: at the other, roller bearings, purely for journal loads, support the shaft adjacent to the timing gears.

These gears, which are precision components, are hardened and have ground profile teeth to ensure exceptionally long life and maintenance of the correct operating clearances between the rotors. The light alloy twin-lobed rotors are of involute form and are cast directly on to the high-tensile shafts and dynamically balanced after machining.

The driving end of the compressor is enclosed in the nose-piece casting, which is extended forward to a point at which it is convenient to pick up a support plate which is bolted to the engine front bearer plate. The drilling of the two holes through this plate, on assembly, is one of only two fitting operations which call for any form of machining and can quite easily be carried out with the aid of the ordinary hand-brace.

A shaft running on bearings similar to those used for the rotor shafts is enclosed in the nose-piece. The coupling device consists of a hard fibre disc provided with six holes equally spaced around two dissimilar but concentric pitch circles. Three dowels or driving pins are provided on a coupling which is secured to the end of one rotor shaft and engages with the disc.

The shaft which protrudes from the nose-piece to pick up the drive is similarly provided, the pins engaging alternate holes in the disc. This type of arrangement ensures that the compressor bearings are not subject to the driving loads and end thrust which would otherwise be transmitted from the driving shaft to the rotor shaft.

With boost pressures up to 6 lb. per square inch one single driving belt is normally used, and both the driving and driven pulleys are manufactured from light alloy. The driving pulley locates inside the existing crankshaft pulley, being secured to it by means of four recessed Allen screws.

The fitting of the pulley is the second of two machining operations called for. A light skimming is required to clean up and centralise the case in the original crankshaft pulley. A protruding spigot on the driving pulley engages in the location provided thus, and, using the pulley as a drilling jig, the four holes are drilled and tapped to take the screws.

The belt, with a top width of $\frac{5}{8}$ in., is

readily replaceable, being kept in tension by means of a jockey pulley also running on ball bearings and arranged to swing in a short arc sufficient to take up all practicable stretch or wear which might be expected before renewal becomes necessary. The jockey pulley is locked in position by a Simmonds nut, a type of locknut used almost exclusively throughout.

The standard induction manifold is replaced by a special manifold secured in position by the original clamps. The supercharger is bolted to the manifold in a position inclined at 20° towards the engine, making a compact unit and harmonising with the rest of the power unit.

Carburetter Mounting

There are several types of carburetter mounting elbows available. For example, the carburetter on the "TC" Series Midget is neatly tucked away to the rear of the compressor, where the original choke and throttle controls are picked up without modification. Similarly in the case of the "TD" and "Y" models where a different elbow is used, the original air cleaner system has been ingeniously modified to suit the new layout.

On the "TC" model a carburetter of the later type, fitted with the hydraulic piston damper, is required, and this is supplied with the correct needle for satisfactory carburation at the boost for which the installation is designed. The carburetter occupies a horizontal position and when fitted to the supercharger requires a straight-mounting float-chamber to replace the original angular type, this again being provided with the kit.

Lubrication for the compressor is taken direct from the main engine oil supply, a tee-piece union being inserted in the oil pressure gauge line at the point where it leaves the cylinder block. Oil is then fed to an adjustable restrictor mounted on the top of the nose-piece. The flow of oil into the unit is visible through a glass tube and is adjusted by a knurled thumb-screw readily accessible when the bonnet is lifted.

Oil Seals

As the rotors operate with a clearance between them it is not necessary nor desirable for oil to enter the actual air chamber. Four standard size long-life proprietary leather seals are employed to prevent oil from entering the air chamber, one at each end of the two rotor shafts. When replacements become necessary, it is not a difficult operation to fit them.

The oil seals do not bear directly on the shaft, as replaceable bushes are fitted, the leather sealing elements of the oil seals making contact with the polished surface of the bushes. The bushes are replaced when new oil seals are fitted, thereby restoring the original sealing efficiency.

After the oil has circulated through the gears and bearings (integral oilways lead a supply to the bearings at the rear of the compressor) any excess above a certain predetermined level is allowed to drain away by means of a copper pipe into the engine via the tappet cover, which is provided with a suitable union.

The following test data and performance figures relating to the "TC" Midget are typical of results which have been obtained from these cars and represent average results from standard road tests. They show the improvement in road performance that may be expected when the engine is fitted with this particular type of low-pressure supercharger installation.

In standard form the engine develops 54·4 b.h.p. at 5,200 r.p.m. The figures given below apply to an engine fitted with a 1¼ in. carburetter and when the supercharger is driven at 1·29 engine speed, to produce a maximum boost of 6 lb. per square inch (70–72 octane fuel).

Acceleration Times through Gears

Unsupercharged	*Supercharged*
0–30 m.p.h. 6·5 secs.	0–30 m.p.h. 5·0 secs.
0–50 m.p.h. 15·3 secs.	0–50 m.p.h. 10·8 secs.
0–60 m.p.h. 23·8 secs.	0–60 m.p.h. 15·2 secs.
0–70 m.p.h. 44·5 secs.	0–70 m.p.h. 25·4 secs.

The power absorbed by the supercharger to produce 6 lb. per square inch boost pressure is in the region of 5 b.h.p., but it is interesting to record that a proportion of this energy is returned to the engine in the form of pressure in the cylinders during the normal induction cycle, and is expended to useful purpose.

In the examples given fuels equivalent to Pool petrol have been used which have an octane rating of 70–72. With a supercharger fitted the ignition advance requirements of the engine differ from standard. After the first initial advance it is necessary, as boost increases, for the ignition to be slightly retarded. Provided engine revs. are high enough this setting does not become critical if the ignition has been set slightly retarded from standard in the first instance. Serious pinking can occur, however, at slow engine r.p.m. with full throttle openings.

If these conditions are likely to be encountered, manually operated ignition is advantageous. This can be arranged to give an overriding effect on the normal mechanical advance and, apart from overcoming the trouble mentioned, is a very useful accessory which enables the driver instantly to adjust ignition to suit varying fuels and engine loading conditions.

Whilst the performance figures quoted may appear remarkable it must be realised that an engine fitted with a supercharger cannot be regarded as race-tuned. Apart from a barely noticeable hunting at low tick-over speeds, the engine remains flexible and smooth. Whereas specialist tuning may result in critical conditions having to be maintained to retain increased output, the effects of the supercharger on the engine remain permanently. The supercharger does in fact allow considerably longer intervals to elapse before decarbonising is required.

For Competition Work

For owners primarily interested in competition and sporting events it is possible to obtain further power from the engine by increasing the boost pressure to 10 lb. per square inch. The identical compressor is used but the drive ratio from the crankshaft is stepped up to 1·48 engine speed and twin belts and pulleys are used. It is necessary to fit a larger inlet elbow and to provide a larger carburetter; an S.U. H4 can be recommended. In all other respects the installation is identical with the standard low-pressure installation previously referred to. It will be observed from the power curve that a considerable increase is obtainable in this way, although in fairness to the engine it is desirable to use a fuel of 80 octane or higher in order to prevent excessive pinking. The installation is primarily designed for competition use as distinct from normal touring.

Further advantages are again possible if an alternative rear axle ratio is available, and in the case of the "TC" and "TD" these are available. Gears with a ratio of 4·875 to 1 may be fitted to "TC" and "TD" models, and for the latter an additional ratio of 4·5 to 1 can be supplied. With the increased torque available acceleration is not impaired by fitting one of these alternatives. Considerable advantages are gained in petrol consumption and normal maximum speed is possible below the recommended maximum r.p.m.

NEXT MONTH:
The SHORROCK Installation

On the right are shown the power curves of the supercharged "XPAG" engine unit, equipped as described in this article.

The supercharger described here is supplied by North Downs Engineering Co., Westway, Caterham England.