MOTOR MAIL

INTERNATIONAL
1979/3

CHAMPION

Yrjö Vesterinen – Bultaco

International Edition

FLYING HIGH

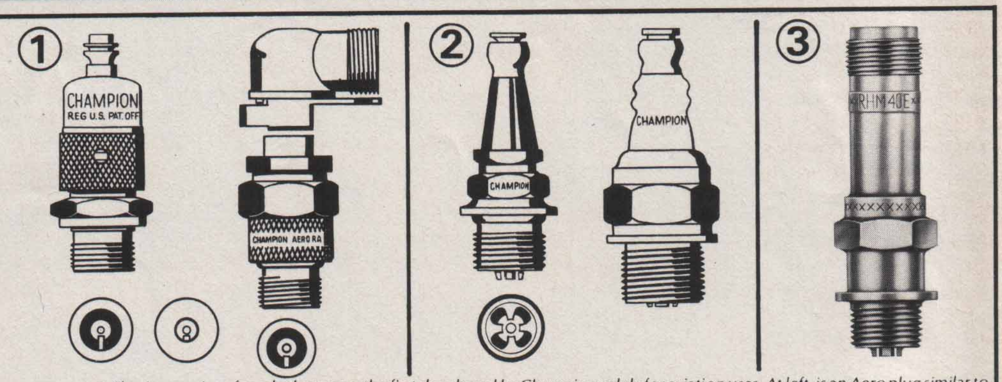
From man's first successful flight in 1903 to his arrival on the moon in 1969 and since, flying has inspired and caught the fancy of millions of persons.

In the 76 years since that first experience at Kitty Hawk by the Wright brothers, aviation technology has improved dramatically and grown far more sophisticated.

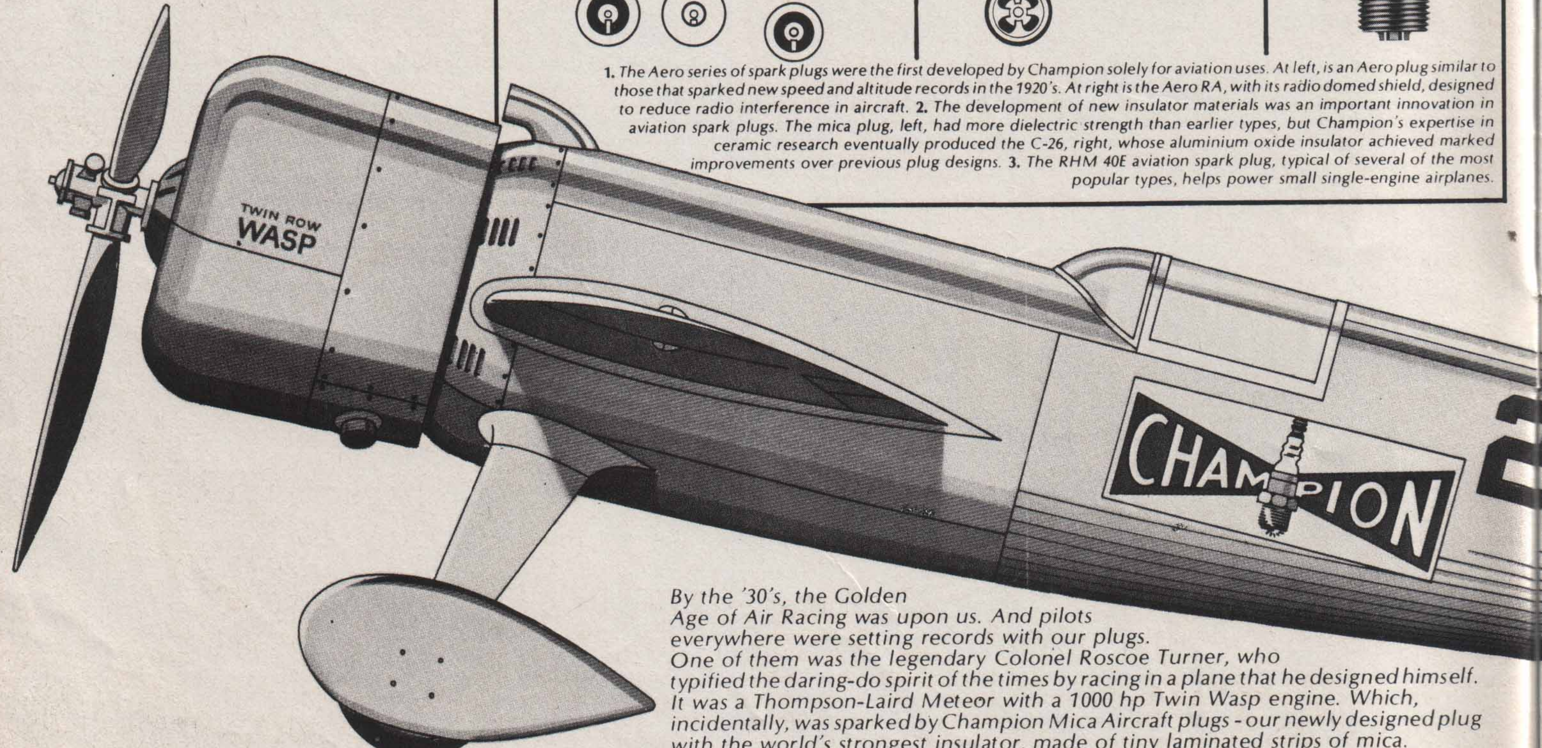
The Champion Spark Plug Company has played a leading role in that technological advancement for more than a half century. When new developments or directions are taken in aviation, Champion is usually involved from the beginning design stages. When dependability and product reliance are required for a new aviation project, designers virtually always call upon Champion for assistance.

The spark to operate the General Electric engines in this Airbus A300 aircraft is produced by Champion jet igniters. The Airbus is manufactured by Airbus Industrie, a European consortium.

In the early 1900's, small planes flew with single ignition systems powered by adapted automobile engines and using Champion automotive spark plugs. These early plugs served well for their day. Champions, for example, were used in the 1917-era, liquid-cooled V-8 engine, the famous powerplant of the Curtiss "Jenny", chief U.S. training plane of World War I,



1. The Aero series of spark plugs were the first developed by Champion solely for aviation uses. At left, is an Aero plug similar to those that sparked new speed and altitude records in the 1920's. At right is the Aero RA, with its radio domed shield, designed to reduce radio interference in aircraft. 2. The development of new insulator materials was an important innovation in aviation spark plugs. The mica plug, left, had more dielectric strength than earlier types, but Champion's expertise in ceramic research eventually produced the C-26, right, whose aluminium oxide insulator achieved marked improvements over previous plug designs. 3. The RHM 40E aviation spark plug, typical of several of the most popular types, helps power small single-engine airplanes.



By the '30's, the Golden Age of Air Racing was upon us. And pilots everywhere were setting records with our plugs. One of them was the legendary Colonel Roscoe Turner, who typified the daring-do spirit of the times by racing in a plane that he designed himself. It was a Thompson-Laird Meteor with a 1000 hp Twin Wasp engine. Which, incidentally, was sparked by Champion Mica Aircraft plugs - our newly designed plug with the world's strongest insulator, made of tiny laminated strips of mica.

which later paved the way for commercial aviation.

In the 1920's, Champion began development of spark plugs specifically for the aviation industry. Before the decade was over, Champion's Aero-1 plugs sparked the world's speed record of 318 m.p.h., plus the world's altitude record of 38,793 feet.

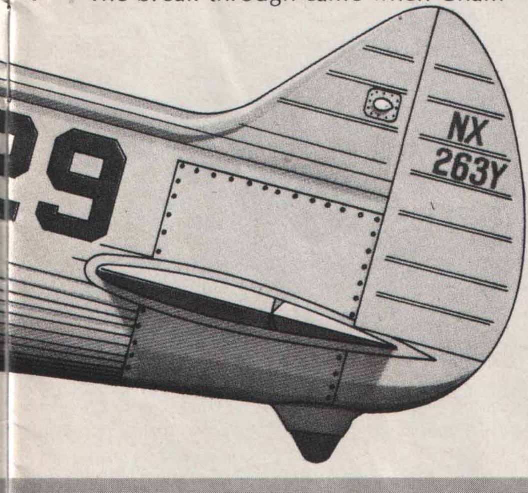
Champion spark plugs helped power the Aeronca Dowager in 1928, which has been credited as the first successful U.S. light plane.

When the radio was introduced to aviation in the 1920's, pilots were quick to complain of the interference caused by unshielded plugs. Champion was first to solve the problem with the Aero RA, a low-profile plug to which Champion clipped a radio dome shield. The plug scored widespread acceptance.

Mica was used as an insulator material in spark plugs in the early days of aviation because it had more dielectric strength than any "porcelain" of that time. And although Champion produced a plug type featuring insulators made of tiny laminated strips of mica, its research engineers pursued a search for a superior material.

The firm's engineers knew from experience the limitations of mica and its point of failure in high compression engines. Mica was subject to more chemical corrosion and oil absorption. Consequently, Champion expanded its facilities for ceramic research, and later doubled and redoubled these engineering quarters, with a determination to produce a satisfactory ceramic insulating material.

The break-through came when Champion engineers developed their famous aluminium oxide insulator and incorporated it into the new C-26 spark plug. Of one-piece construction and gastight, the new insulator had exceptional mechanical strength, strong resistance to thermal shock, and no tendency to absorb oil. Moreover, the C-26 could withstand full power take-off and long climb without preigniting.



Through the years, this new aviation spark plug produced favourable results in U.S. Army and Navy tests on experimental high output engines. While testing continued, the company built a pilot plant for production of these types. By 1941, approximately 500,000 aviation spark plugs were produced a year.

Research has continued steadily since those early days of the firm's involvement in aviation. Such new developments as refinement of the massive electrode, all-weather barrel, stable heat rating, zinc-plated shell, new electrode alloys, and new cementing techniques are helping to maintain and further Champion's unmatched reputation for quality dependability, and performance.

The turbine engine, whose development began in England, was brought to the United States by General Electric. This first U.S. jet aircraft engine utilized an igniter core assembly made by Champion. Since then, the company has made thousands of different jet igniters for experimental, developmental, and production engines.

Its contributions to the gradual acceptance of the jet turbine as the dominant commercial aircraft engine include the first annular gap for high-tension igniters, the first interlocked construction, the first successful recessed centre electrode, and the first welded right angle igniter assembly.

Its reputation for research and development in both the traditional reciprocating and new jet igniter aircraft engines has caused engine manufacturers, when developing new aviation powerplants of any kind, to seek out Champion's assistance in the design stages.

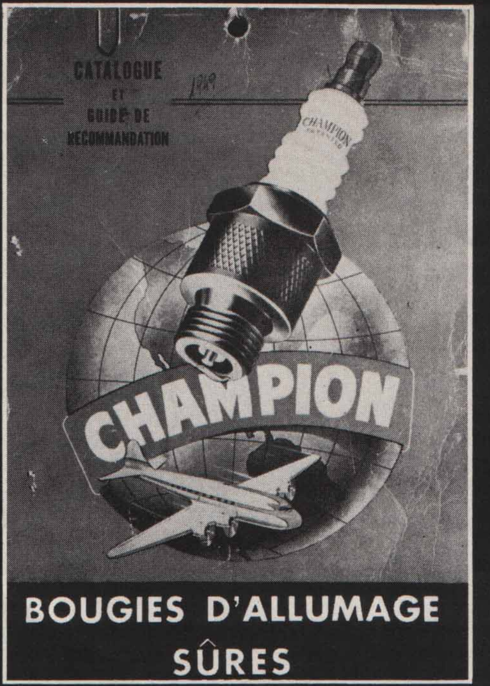
For example, a sophisticated turbine igniter designed by Champion helped launch the second stage oxygen-hydrogen engine of the Saturn C-1 rocket in the U.S. space programme.

The supersonic Concorde aircraft is powered by four Olympus Turbojet engines produced by Rolls-Royce and the Société National d'Etude et de Construction de Moteurs d'Aviation. Each engine is fired by two specially-engineered Champion igniters.

Champion manufactures the jet igniters for the General Electric engines which power the Airbus A300 aircraft, being built in Toulouse, France, by a European consortium, but using significant quantities of U.S.-made parts.

Primarily due to these research and development accomplishments that have parallelled the progress of the aviation industry, Champion has established itself as the leading supplier of aviation spark plugs and jet igniters worldwide.

The firm supplies all the major commercial airlines as well as meeting most of the military requirements of the United States and its allies. In the rapidly growing general aviation field, Champion also ranks as the number one spark plug and aviation supplier in the world.



Do you remember such historic names as Isotta Fraschini, Armstrong Siddeley, Maybach and Bugatti or models like the Balilla, Vanguard and Juvaquatre?

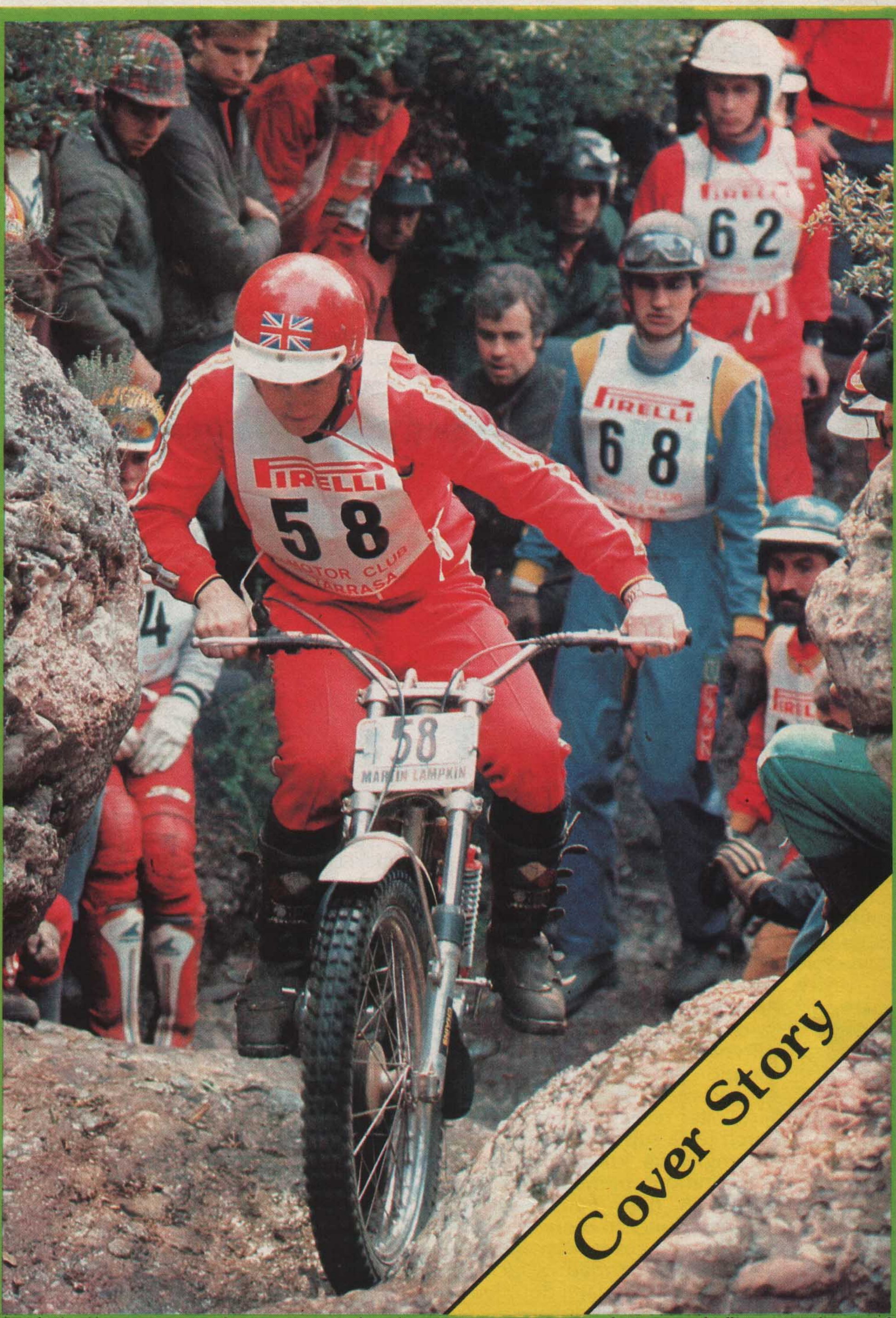
All these are now just a fond - or perhaps not so fond - memory of an era of motoring which was different from today. One thing that all of these vehicles have in common is the fact that they all appeared in a Champion catalogue of 30 years ago - in 1949.

The significance of this fact is that when Champion recently ran a Europe-wide competition to locate the oldest spark plug catalogue, 1949 was the oldest one that turned up. The catalogue (which is shown in the picture) was - rather confusingly - published in France, printed in America and located in Italy! The man who found it was Signor Giovanni Berti of Bassano del Grappa.

Amongst the other interesting relics that arrived was the wall chart that you see pictured and that one, sent in by Monsieur Roger Depeyre from Goulens, near Agen in France, dates from 1939.

We checked with Les Barnes, Champion's Technical Services Manager in Europe, to see if he had ever come across any so old. But he just smiled and produced one from 1937!

TIME for TRIALS



Like many sports, Trials were invented in Britain. Developed in the 1920's by a group of British motorcycle enthusiasts, the sport was initially dominated by names such as Ariel, Cotton, Greeves and A.J.S.

And like most good ideas, trials have become international in manufacturer, rider and spectator interest.

The basic concept of a motorcycle trial is to test the rider's ability to control his bike precisely over difficult terrain. A trial will consist of 10 to 25 "sections" marked out in the most difficult conditions the organisers can find. Each competitor has to cover the sections under observation and loses points for every time his foot touches the ground (up to a maximum of three points). The main objective is to keep the machine moving; the penalty for stopping or straying beyond the narrowly-defined limits of the section is five points or a 'maximum' as it is known amongst enthusiasts. There is no aspect of speed in trials. There is an overall time limit within which the competitor must complete the course, but being the fastest rider carries no additional points.

Because of their emphasis on precision rather than speed, trials are not a mass spectator sport. The fact that they are run in rough country and cover a large area are additional reasons for low public interest. However, the sport could be on the road to mass acceptance with the development of indoor trials. Run in large halls and sports stadiums, indoor trials concentrate all their activity in the small space of the arena and allow the spectators to follow all the action from a comfortable seat. Like most developments which bring specialist sports to a wider audience, this trend in trials isn't all that popular with the purists who consider the difficulties involved in watching 'real' trials as part of the fun.

One might expect the Japanese to be 'top dogs' in trials, as they are in most other forms of motorcycle sport. This is not the case, however, and Spanish manufacturers have made trials their own territory, with the names of Montesa and Bultaco filling the championship lists with such riders as Ulf Karlson, Malcolm Rathmell, Marland Whaley and Jaime Subira on Montesas and Yrjo Vesterinen, Martin Lampkin, Bernie Schreiber, Soler and Gargot on Bultacos.

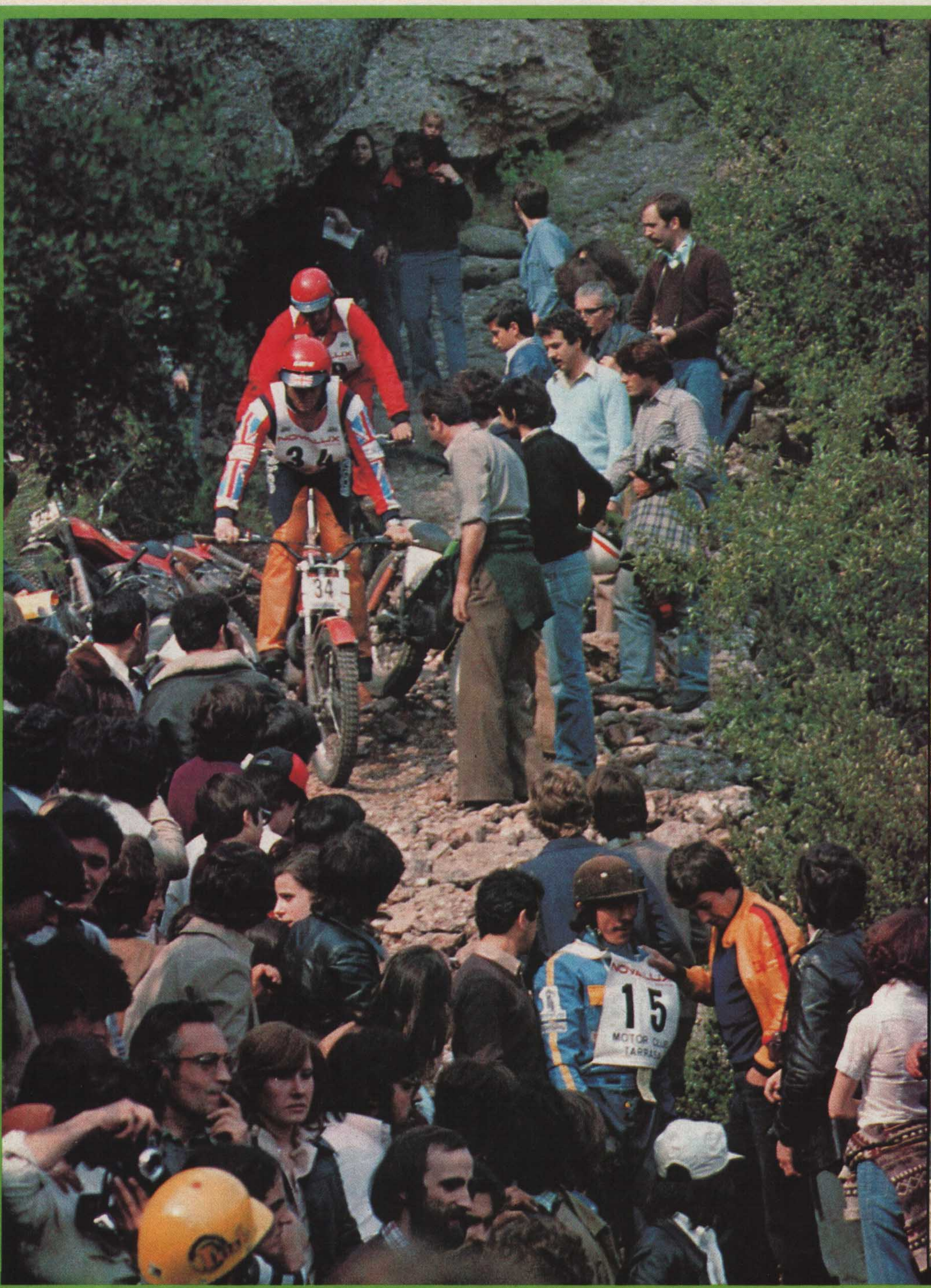
To find out something about what makes the Spanish manufacturers so successful, Motor Mail talked to Pedro Pi of Montesa about their design philosophy. According to Pi, one reason for the Spaniards' success is the fact that their approach is more on a human rather than on a technological level.

You cannot measure the 'feel' of a bike on a dynamometer and you cannot develop a good trials bike on a drawing board. You have to ride the bike and modify it according to what you find in competition - only after you have done this can you put the bike into production. The smaller Spanish factories, depending on the intuition of craftsmen rather than massive Research and Development departments, are better suited for working in this way and this, believes Pi, is a big factor in their success.

The requirements of a trials bike engine are rather special, according to Pi, the most effective being the single-cylinder two-stroke. Engine capacity has shown a gradual increase to its present figure of around 350cc, but sheer power is of little use in trials riding - it is torque and balance which count.

Ignition for trials engines presents particular problems. Because of their low operating speeds - normal idling speeds are of the order of 700 to 800 r.p.m. and can be as low as 500 r.p.m.-electronic ignition is unusable because at this speed it will simply not function. The low speeds also demand special performance from the spark plugs. Idling at 500 r.p.m. means low combustion chamber temperatures so the plugs must be able to fire without cold fouling whilst at the same time being able to run up to 7000 r.p.m. without problems when needed.

Close collaboration between Champion and the factory teams in trials competition has led to both Montesa and Bultaco specifying Champion for their production bikes. Champion for their part make no secret of the fact that they have learnt a great deal about motorcycle plugs from trials - lessons that they have been able to apply to plugs for road bikes and even mopeds.



Naturally, the specialist nature of a trials bike demands certain peculiarities of frame design. Pedro Pi explained why. "You have to remember that we are dealing with a very unusual way of riding a bike. In trials, the rider spends nearly all his time standing up so the footrests are mounted well back and the handlebars well forward. The saddle is practically redundant so it can be very simple. Ground clearance is very important so that has a great influence in frame design. Because a trial doesn't cover much in the way of distance, we can get away with a small tank that only holds something like 5-6 litres of fuel. Machine control is the most important consideration so we pay particular attention to steering geometry and the suspension system. The suspension itself is entirely conventional, but we do go to great lengths to match the spring rates and shock absorber settings to the characteristics of each course."

"Wheels need to be light to reduce inertial forces and we can use small brakes because the bikes don't reach high speeds. However, it's most important that the brakes continue to work in waterlogged conditions. Tyres are very important. Tread compounds are soft and the carcase must be flexible to work efficiently on rough ground. Riders aren't able to change their tyres to suit different conditions so a good trials tyre must be able to work on dry or wet surfaces of all types from sand to grass to boulders to deep mud. The tyre designers are limited in what they can do because trials tyres are still limited by the original British rules, which decreed that since a bike has to travel on the road from one section to another, the tyres must be safe for road as well as cross-country use. There are strict rules about such things as tread design, pattern depth and sizes."

In Señor Pi's opinion the main qualities demanded of an ideal trials rider are concentration, balance, and machine sympathy. It is strange but true that these qualities are often combined in the top trials riders with a sense of humour and a pleasant personality. There are no superstar egos in trials, probably because of the need for a gentle touch, rather than strength, for controlling the bike.

Perhaps is is something in the Spanish character - a character which appreciates the artistry and skill of the bullfight rather than the act of killing, a character which idolises those who can coax rather than drag melodies from a guitar, which has made their machines the best in the world for this, the most gentle and precise of the motorised sports.

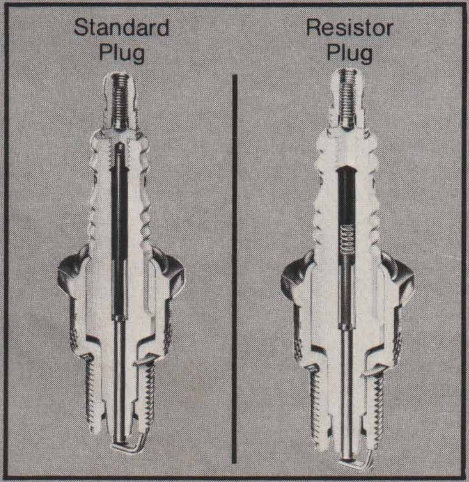
PLEASE DO NOT DISTURB

Once upon a time, nobody bothered much about radio interference from ignition systems. Radios operated on relatively low frequencies where interference was less of a problem, and anyway there weren't as many cars around.
All that has changed. It was probably the spread of television which gave real impetus to the suppression of ignition system interference: people were prepared to put up with a few crackles on their radios, but it was another matter when their TV pictures were blurred. Laws were passed to limit the interference caused by cars. Britain had regulations as early as 1953. Since then national laws have been overtaken by the international ECE system as far as Europe is concerned, with ECE 10 covering radio interference suppression.

To begin with, suppression was a simple business. It was just a matter of introducing a resistance somewhere in the high tension circuit to damp down the oscillating spark effect which caused the stray radio emission. The methods tried in those days included resistive brushes in the distributor cap, and the cutlead suppressor in the king lead from the coil to the distributor. The spark plug resistor cap was also early on the scene, and is still in great demand today. Champion have just introduced a new improved type of cap (Motor Mail 2/1979) to cater for this continuing market.

A later form of suppression is the resistive lead in which the metal core is replaced by carbon-impregnated nylon fibre with a much higher resistance. Despite some problems with these resistive plug leads, usually due to mishandling in service, they have been widely adopted by the motor industry.

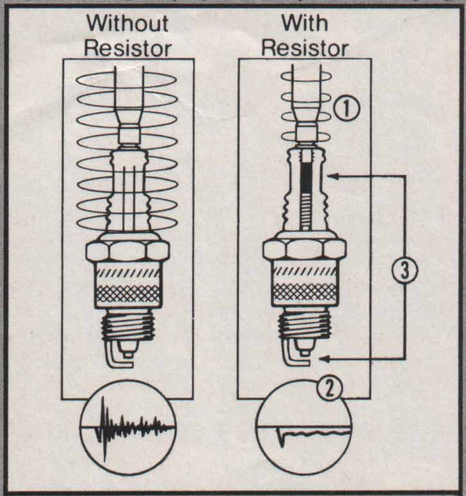
Fig. 1 Resistor plug versus standard plug.



However, ECE 10 has not stood still. Its requirements have been progressively tightened up, calling for even better suppression - a need backed up by the interference motorists themselves have often suffered in the new generation of VHF car radios. The answer is the resistor plug.

There is nothing new in the basic idea of the resistor plug. It has always been known that the closer the resistance could be placed to the source of interference - the spark itself - the more effective it would be. On the other hand, building the resistance into the plug itself made the design more complicated, which inevitably pushed up the cost. As long as resistance further up the line proved sufficient, the resistor plug remained no more than an idea.

Fig. 2 Principle of operation of a resistor plug.



Resistor plugs are very effective in suppressing ignition interference for three important reasons:

1. Radiation from ignition cables is greatly reduced in strength.
2. The high frequency part of the spark is virtually eliminated.
3. The resistor element is near the spark plug gap for maximum effectiveness.

The advent of tighter restrictions has meant that the resistor plug has become an important part of the Champion production programme. Very often, cars need both resistor plugs and resistive plug leads to meet the regulations in full: for any particular car, the severity of the interference problem depends on the detail design of the engine and of the front body panels; some designs have a greater measure of built-in shielding than others.

Where resistor plugs are specified, they are identified by the prefix R: thus a standard N-9Y plug can be replaced by the RN-9Y, which is physically identical except for the carbon resistor which forms part of the central electrode assembly. Changing to the resistor plug can be a good move if, for instance, interference is being experienced in a VHF radio installation and cannot be eliminated by other means. The only snag is price: a resistor plug costs about 20 per cent more than its standard equivalent. This means there is a temptation, where resistor plugs are fitted as original equipment, to replace them with standard plugs and save the extra cost when the time comes. This is illegal, since the car will then no longer meet ECE 10; it is also anti-social, which is perhaps rather more important.

To complicate the picture, Champion actually make three types of resistor plug. Though the R-prefix type is by far the most common, there is also an O-prefix plug, a "premium" type in which the carbon resistance is designed to have more stable performance under wide variations of voltage and temperature. The O-plug is used only where specific problems arise, usually at high radio frequencies, to demand its use.

There is also a completely different type of plug, identified by a Q-prefix. In this type, the simple carbon resistance is replaced by a small coil with a high inductive reactance. It is intended for use with high-energy capacitive-discharge ignition systems, with which the simple resistance suppressor is ineffective. For the most part, Q plugs are found in high-output two-stroke marine engines - and they may also be of a surface-gap type. It is worth bearing in mind, however, that capacitive-discharge systems are now being offered for car use, not least as "do-it-yourself" kits for the home mechanic who wants to fit his car with a superior ignition system. Such systems may, in certain cars, cause unacceptable radio interference when fitted - and neither resistor plugs nor plug leads will do much to rectify the situation. Nor, for the time being at least, are Q-prefix plugs readily available as replacements.

It should always be remembered that radio interference can be due to many things, not simply to the basic components aimed at overcoming it. Poor installation and maintenance can play their part in many problems, and it is always necessary to check the continuity of the high-tension circuit when trying to pin down the source of persistent interference. A poor connection at any terminal can create a small spark gap and consequent severe interference; such gaps are most often found at the spark plug terminals, the coil tower connection and the distributor towers. Clean, tight joints may well solve a problem which failed to succumb to careful bonding or the fitting of extra capacitors.

There is no doubt that the R-prefix plug will become virtually standard during the next few years. A glance at the Champion manual will show how many cars already use them as original equipment. The important thing to remember is that they are no different from the mechanical point of view - but for the sake of peace and quiet on the radio waves, an R-plug should always be replaced by another R-plug. Keep yourselves and your customers legal.

ROLLING WORKSHOPS

There was a time when all you needed in the way of transport for a Formula One team was an old bus with the seats ripped out. The car went in the back together with all the necessary tools and there was still plenty of room for a couple of beds and a space for cooking - so long as you didn't mind all your food out of tins! But those were the old days. To-day's Formula One teams stay in four-star hotels and travel first-class everywhere. It's the same with the cars and the place of the pensioned-off bus has been taken by massive transporters with space for two or three cars and with every facility needed for looking after the cars at the circuit.

It's all part of the professional outlook of today's racing teams. If a sponsor is paying an enormous amount of money to have his name publicised by a racing team, it's up to the team to ensure that the cars always put up the best possible performance and look their best at all times. In order to achieve this, there must be the equivalent of a mobile workshop at every Grand Prix and every team now has at least one massive articulated lorry, with thousands of pounds' worth of equipment, which enables them to carry out all but the biggest repair jobs in a race track paddock.

All the trucks have been specially built and equipped for the job and usually follow the same basic design principles. All the teams use articulated tractor and trailer combinations because not only are they more manoeuverable in the confined spaces of a race paddock, but they can also continue their journey easily in the event of a vehicle breakdown. With the crowded nature of a Formula One calendar, a team cannot afford to be held up by a transporter breakdown - with an articulated unit, it's a simple job to unhitch the trailer and continue the journey with a new tractor.

Another design feature which all the trailers share is a large awning. Although some race circuits have proper garages in which the teams can work, there are many more where the work has to be done outside and it is at these tracks where the awning is used. Folding out from the side of the truck, it provides shelter from the weather, be it rain or hot sun, and forms a self-contained unit with most of the facilities of a top-class workshop. These facilities will include gas and arc welding, a lathe for turning small parts, a full range of tools, and fullsize workbenches.

Naturally, the trailers also carry a large number of spare parts for the racing cars and teams often have a second, smaller vehicle which carries large spares such as wheels and engines. Because of the large number of spares which have to be carried, ranging from new body panels to the smallest washers, the trailers are marvels of planning, with every bit of spare space used to the best advantage.

A vital part of the equipment is of course a generating unit to power the various electrically powered tools and the lighting system which enables the mechanics to work long into the night when a last-minute engine change is called for. The generator will also provide the power for a refrigerator, for cold drinks, or an electric kettle to make the never-ending supply of tea which keeps English racing mechanics going!

In the days of the converted bus, everybody would take turns to drive the transporter, but in these days of specialisation the transporter driver is also a specialist and he will be hired for his driving experience rather than his ability with a spanner. It is not just the increasing complexity of the vehicle which has led to this specialisation. The tighter laws governing such matters as hours of work require expert knowledge and the kind of experience which knows that certain border crossings are easier than others is also of immense value in maintaining tight schedules.

Although the trailers are built to each team's special order, the tractors tend to be standard models, with Volvo as the most popular manufacturer. Although Formula One cars are the most developed form of wheeled vehicle, and their designers amongst the most innovative in the industry, none of the modern teams has followed the example of the Mercedes racing team of the fifties, who designed and built a special transporter capable of travelling at over 100 mph (160 kph). The only evidence of any form of 'go-faster' modification is on the Marlboro McLaren transporter, which has one of those bolt-on wind deflectors on top of the cab - and that is probably more in the interests of fuel economy than speed.

Immaculately painted in their sponsors' colours, the team transporters are an interesting feature of Grand Prix paddocks all over Europe. Next time you are at a big race and you find that you can't get near the cars during practice, take a walk round the transporters in the paddock - they're almost as interesting and much easier to approach!

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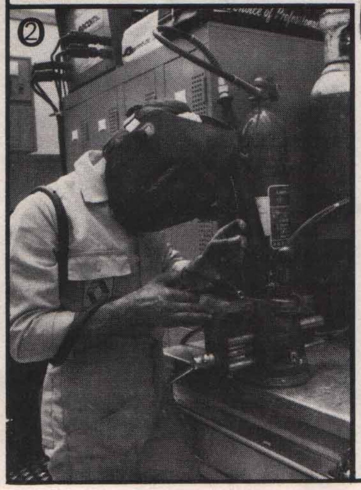

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1. The Renault team's transporter is one of the most modern in Formula One and is hauled by a tractor made by the company's Berliet truck subsidiary. Note the storage space built into the sides of the truck. 2. Electric arc welding in the Renault transporter. 3. Working on the cars under the awning fitted to the side of the Renault Formula One team's transporter.

VIRTUOSI of the THR

It is a strange sight. The sinuous, slow-moving machines, their wheels grappling for traction on the glistening clay. Two of these lumber across the rutted surface like a grotesque parody of some primeval scene.

The two articulated sections of the leading machine writhe as the wheels slither sideways on the wet, brown clay. The machine behind nudges its upturned nose hard against the crooked-finger tail-hook of the first machine. The nose clanks down tight on to the hook and the engines notes rise as the two vehicles, now locked together, move forward up the slope.

Both machines - they are called scrapers - have two diesel engines of around 300 bhp each. The outputs of each engine are delicately balanced and under the control of the driver via sophisticated automatic transmission.

The scrapers are beginning to lose adhesion again. The treads of the enormous tyres shine with the slippery clay and even the combined power of 1,200 bhp is failing to move the vehicles forward. A further hoarse-throated 300 bhp arrives on the scene - this time moving on surefooted crawler tracks. The dozer-blade snuggles against the tail of the rearmost scraper and the trio, now 1,500 bhp strong, edges steadily forward. A bizarre procession of steel muscle. A clumsily choreographed ballet, but with a unique grace.

Now consider a very different type of vehicle. One with an output of 3,000 bhp,

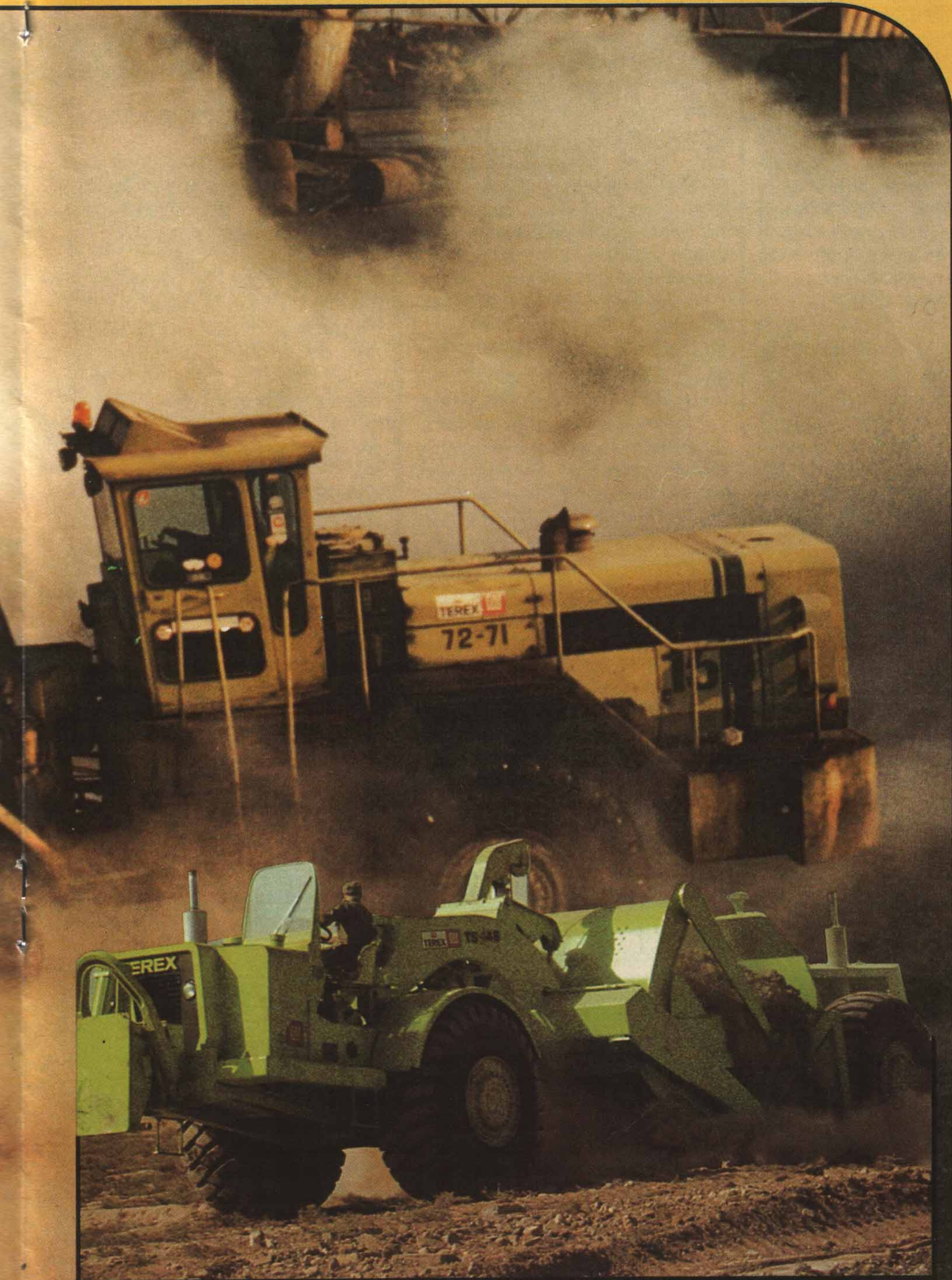
ROTTLE CONTROL

nearly 10 m. (30ft) wheelbase and a payload capacity of 350 tons. Motive force comes from a two-stroke diesel engine which in turn motivates a generator which supplies electricity to four traction motors at the hubs of the driving wheels.

The driver sits nearly 6 m. (20 ft) above the ground and with the tipper body raised he would be unable to get his vehicle beneath any bridge lower than 17 m. (56 ft.)

The ambition to control such a machine would surely threaten the pole position traditionally held by the railway engine in the stirring heart of a schoolboy of any age. The Terex Titan is the giant among giants. It is a machine requiring a considerable amount of elbow room to enable its capabilities to repay its staggering cost to its owner.

The purchase of such machines cannot be considered lightly. For example, the type of off-the-road hauler usually seen in Europe - with a payload of about 85 tons - would cost £ 250,000 (sterling). The money would buy a more conservative specification; around 800 bhp from a turbocharged, inter-cooled, two-cycle Diesel. There will sometimes be a sixteen cylinder engine driving the rear wheels through an automatic transmission. Automatics have big advantages over manual transmissions with which the driver had to stop to change gears when the going was rough.



There are three main types of machines used in road building. Before the twin-engined scrapers get to work, the first vehicle to make its mark on the virginal site is the crawler bulldozer, which clears the ground of surface obstacles - rocks, trees, etc. At a later stage in the work, the crawler may return, this time with a ripper attached to the back - a sort of metal canine tooth which actually cuts deep down into the surface. The crawler is one of the smaller vehicles to be seen on site, but even here the power is likely to be in excess of 300 bhp and the cost can rise into the six figure range.

The third type of vehicle is the loader, which must be matched to the size and capability of the hauler and other vehicles it is working with. Ideally, the loader, which will have a 400-500 bhp engine, should be able to fill the tipper compartment of the hauler in four or five buckets-full. If it takes more than this, the machines are costing the operator more money than they need to because they are working below capacity. If, on the other hand, the loader has a bucket which is capable of filling the hauler in less than the optimum number of passes, there is a risk of damaging the hauler.

The men who drive all of these machines are the aristocrats of their trade. There are only a handful of contractors who undertake the work which demands the use of these men and the machines they operate. Ironically, although their job is a skilful and demanding one, the 'paper' qualifications are virtually non-existent. As the vehicles are used off-the-road, technically not even a driving licence is required, but no contractor will entrust equipment costing such huge sums to a man who has not thoroughly proven his expertise.

There are relatively few established, skilled drivers and they are generally known throughout the trade. They are jealous of their reputations and abilities. They may have begun as cleaners of the machines, or greasers, but they have risen to be masters of the delicate touch on the throttle, virtuosi of the sensitive balance between traction and loss of adhesion - and maestros of the rock-bucket.

Their sensitivity to the machine must be subtle, as is that of a racing driver to his car. Both professions rely on an intimate awareness of the relationship between a vehicle and the surface it moves on.

The Champ

Champ's garage bought a new multimeter for measuring voltage, current and resistance around the car's electrical system. It was a lovely piece of equipment and Champ had a bright idea. He would check the continuity across the spark plugs of that nice little family saloon.

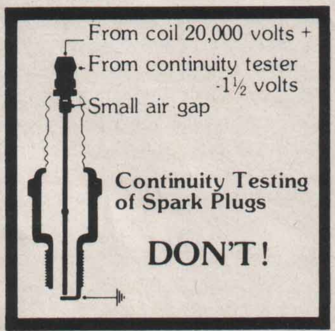
Champ took out the four spark plugs . . .

. . . and carefully connected up the multimeter leads to the top terminal and to the firing electrode of the first one.

He was amazed to get three zero readings out of four.

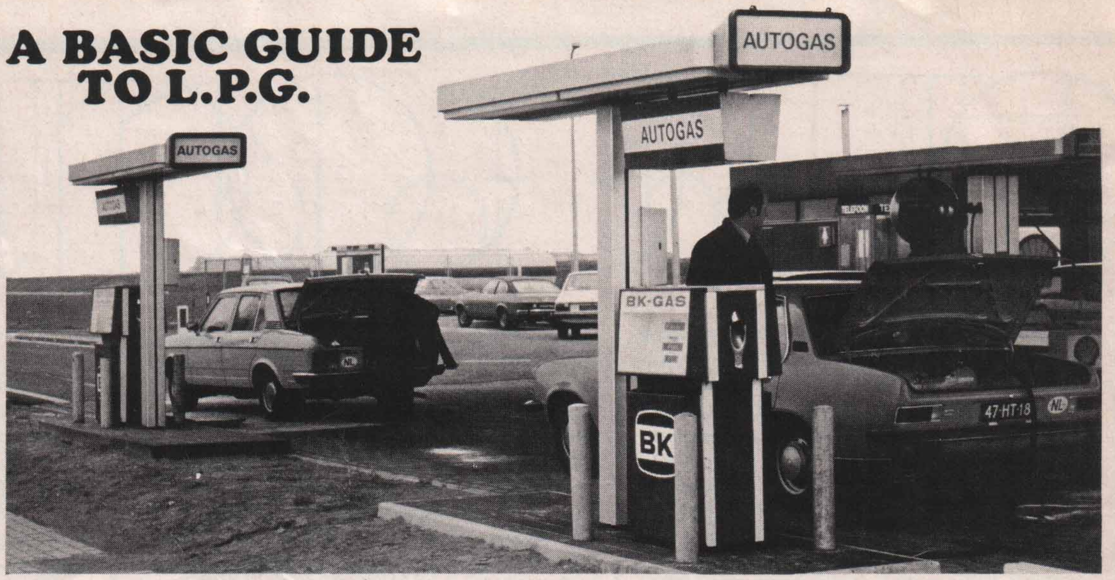
"Hey, Champ, don't you know what you're doing?"

"That piece of equipment is great on the rest of the car but its low voltage output just won't measure up to testing a spark plug's continuity. Think of those 20,000 volts or so which the car's H.T. system passes through the plug, bridging the air gap in the centre electrode, to make a powerful spark at the right place - the plug gap."



CHAMPION

A BASIC GUIDE TO L.P.G.



In 1978, approximately one out of every ten passenger cars sold in Holland was modified to operate on L.P.G. - Liquified Petroleum Gas. Because there are financial incentives for operators of vehicles which are intensively used and consume fuels other than normal petrol, the Dutch have more experience of using L.P.G. than most. Many other countries are now studying the Dutch example with an eye to increasing the use of L.P.G.

L.P.G. is a by-product of the production and refining of crude oil. It is composed of the combined gaseous elements of the crude oil, liquified under pressure. To maintain its liquid state, it has to be stored and supplied under pressure. Transport and delivery are not difficult, however, and it can be easily handled by the normal gasoline and diesel fuel distribution systems. This, of course, is a vital element in the widespread use of L.P.G.

Although L.P.G. is suitable for any normal combustion engine, the vehicle must undergo certain modifications to adapt it for L.P.G. use. The first is the installation of a proper tank capable of holding the pressurised gas. In Holland the tanks must be capable of withstanding a pressure of 30 atmospheres and have a safety valve which releases the gas if the pressure in the tank rises above 18 atmospheres. Normal operating pressure of the gas is between 6 and 8 atmospheres. An additional safety device is the fitting of a limiter which allows the tank to be filled to within only 80 per cent of its capacity, thus allowing for 20 per cent expansion.

To convert the L.P.G. into a form in which it can be used in the engine, it has to pass through an evaporation/pressure regulation unit. In this the liquid gas is returned to its gaseous state by gradually reducing the pressure and simultaneously heating it. The gas is then introduced into the inlet side of the engine through a mixer control which combines it with the air drawn in during the normal induction cycle.

L.P.G. is equally suitable for engines with fuel injection or normal carburation and can also be used as an additive in diesel engines. The fact that L.P.G. is fed into the engine in the form of gas gives it advantages over normal fuels which enter the combustion chamber as a liquid/air mixture. Because it is a gas, it mixes more readily with the air and gives better combustion. This results in almost complete burning of the fuel, in very low pollution levels, particularly in terms of carbon monoxide, which is present in very small quantities.

Another advantage of L.P.G. is the elimination of the corrosive elements which are formed during cold starts with a normally-fuelled engine. The absence of these deposits means that L.P.G.-fuelled engines are less prone to bore and piston wear.

Because it has to have various proportions of other gases such as propane and butane in its composition, it is not possible to give L.P.G. a constant octane value. However, it can be relied on to be comparable with premium grade petrol, with an octane rating of over 100.

Although L.P.G. provides as much power as petrol on a weight for weight basis, it is less dense, and therefore in the volume units used for fuel consumption comparisons, it is less efficient than liquid fuels. As a rough guide, L.P.G. is up to 15 per cent less efficient per litre than gasoline. Therefore a car which uses 10 (ten) litres of petrol per 100 km will use 11.5 litres of L.P.G. Actual consumption figures will, of course, depend on individual installations and patterns of use.

Similarly, compared with petrol, L.P.G. can sometimes result in a slight loss of power. Thus it is used to its best advantage in large-engined cars where any power loss is less noticeable.

With L.P.G., combustion chamber temperatures tend to be higher than when petrol is the fuel, because it lacks the cooling properties of a liquid fuel. As a result there is increased danger of burnt valves and damaged valve seats. Valve seats are also at risk because L.P.G. contains no lead additives like normal petrol. The lead additives tend to build up on valve seats, giving them an extra measure of protection. For this reason, it is often recommended that a new engine is run-in on normal fuel, to build up this protective layer, and then switched to L.P.G. Legislation restricting the lead content of petrol has made manufacturers consider this problem however, and more modern engines have specially hardened valve seats. Current American engines, specially developed to run on lead-free fuel, are particularly suitable for use with L.P.G. for this reason.

In the past, the high combustion temperatures inherent in L.P.G. operation could shorten spark plug life, but this problem has been overcome and modern Champions have a large operational safety margin. Any queries about spark plug applications for L.P.G. use should be referred to the Champion Technical Services representative at your local Champion office.

Because L.P.G. is basically an explosive gas under pressure, it is vital that L.P.G. conversions are carried out by trained experts using approved components. If the proper safety precautions are observed, the fuel is quite safe and it is worth noting that in Holland, where use of L.P.G. is more widespread than anywhere else, there has been no known case of an explosion resulting from an accident involving L.P.G.-fuelled vehicles - even when the accident caused a fire.

The energy crisis made people aware that they must use the world's energy resources to the maximum and this has led to an increase in the production of L.P.G. from gases which used to be burned off during the refining process. In addition to L.P.G. made at the refinery, it has also been found to occur naturally in a number of oilfields -particularly in the British section of the North Sea, which is estimated to contain 12 per cent of natural L.P.G.

The exploitation of the North Sea has not meant an upsurge of interest in L.P.G. in the United Kingdom, although it is popular for use in industrial vehicles such as forklift trucks. Normal use on the roads is limited by the relatively small number of garages which stock gas. This means that its use is mainly restricted to people who operate their vehicles in an area where a supply is assured: long distance travel means that petrol has to be used for a large proportion of the time due to a lack of L.P.G. stocking points. From the point of view of economy, L.P.G. has much to offer, costing only approx. 71 p per gallon compared with two star petrol at approx 87 p. However, this price differential is to a certain degree due to the lower rate of tax levied on L.P.G. and it is likely that an increase in the use of L.P.G. would quickly be followed by an increase in tax to make up for revenue lost as a result of falling petrol sales.

Although increased production of L.P.G. has improved its availability on the retail market, it is still not universally available and in fact the supply position in European countries other than those with good supplies (Italy, Holland and Denmark) leaves much to be desired. Drivers of L.P.G.- converted cars need have no worries about running out of fuel however, because the normal petrol system is retained and it is simply a question of turning a switch to change over from L.P.G. to petrol and the driver has the option of filling up with petrol when L.P.G. is not available.

IGNITION SYSTEMS FOR L.P.G.

L.P.G. (liquified petroleum gas) not only helps extend the life of the world's dwindling reserves of crude oil but offers the environmental advantage of reduced exhaust-gas pollution. In addition it ensures smoother running and, provided the ignition system is in good order, easier cold starting.

L.P.G. has been quite widely adopted in the U.S.A., initially for agricultural tractors and industrial vehicles but more recently for roadgoing trucks also. European usage has been orientated more towards the smaller on-highway vehicles - taxis and private cars - partly because of different situations on the two sides of the Atlantic. Since L.P.G. is more generally available in the U.S.A. than over here (owing primarily to the more favourable taxation level), it usually forms the sole fuel; in contrast, the relatively limited European availability has resulted in dual-fuelling in which engines are converted to run on either L.P.G. or petrol, with the facility of switching from one to the other whenever required.

So far as the ignition system is concerned, there is considerable difference between operating on L.P.G. alone and dual-fuel operation, since what is best for one is not best for the other. L.P.G. has slower burning characteristics than petrol, and has a higher calorific value while also being less liable to detonate or knock when burnt at high compression ratios.

An L.P.G.-only engine can be optimised for these characteristics. To cater for the slower rate of combustion the ignition timing can be advanced. The higher calorific value, which raises the temperatures in the cylinders, can be dealt with by using a colder grade of spark plug, which is in any event desirable because the evaporative cooling effect of petrol droplets in the mixture is absent. In addition, the superior anti-knock rating of L.P.G. enables appreciably higher compression ratios to be used, with benefit to thermal efficiency and hence fuel consumption. However, raising the compression ratio further elevates the internal temperatures, thus making cooler-running plugs even more necessary.

The disadvantage of L.P.G. compared with petrol is its greater reluctance to ignite. Consequently, a considerably higher voltage is needed at the spark plug gap to ensure consistent firing. It may be sufficient merely to reduce the gaps by about 0.005-0.007 in. (0.127-0.178 mm) from the recommendation for petrol duties, provided the plugs are in good condition and the contact-breaker points are also sound, and their gap correctly adjusted. However it would be advantageous, where possible, to replace the conventional ignition system with an electronic type which has a basically higher voltage capability.

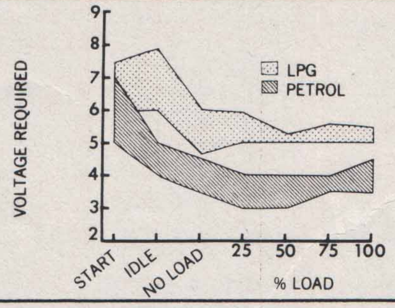
The voltage requirement at the plugs increases if the L.P.G./air ratio is weakened beyond the chemically correct proportion, so care has to be taken to avoid over-weakness in the carburation. A possible source of difficulty here is the inlet manifold design. Some petrol engine manifolds do not provide sufficiently uniform cylinder-to-cylinder distribution when operating with L.P.G.

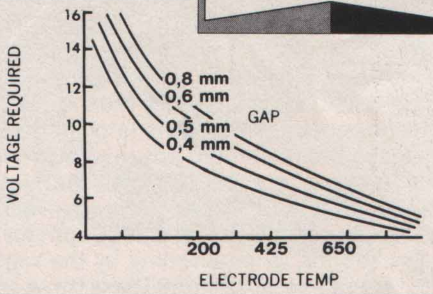
In terms of power output, L.P.G.-burning engines benefit from being given the ability to inhale relatively cool air. The lower the intake air temperature, the greater the power produced. This means that restrictions in the induction system should be reduced to a minimum. For example, air-filter elements should be renewed regularly to prevent blocking with dirt. The intake air should not be preheated by the exhaust manifold as it often is for petrol engines. Obviously the benefit of good breathing on the inlet side should be matched by a free-flowing exhaust system, and restrictions such as dented or carboned-up silencers or tailpipes eliminated.

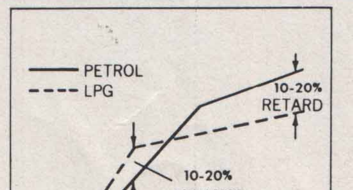
Having said all this for engines burning L.P.G. only, what comments can one make on dual-fuel operation? Clearly, the ignition timing cannot be advanced significantly, or the compression ratio raised, without the risk of detonation or pre-ignition (both potentially damaging) unless a higher grade of petrol can be used. Again, fitting colder spark plugs for the L.P.G. could lead to fouling when the engine is running on petrol.

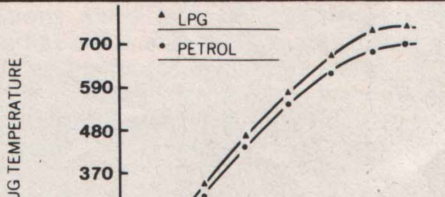
The best of both worlds is therefore unattainable, so the dual-fuel operator can do no more than seek a mild compromise. Reducing plug gaps a little, for instance, is not going to have a major ill-effect on the performance when running on petrol, while converting to electronic ignition will almost certainly be beneficial through the higher voltage available at the plugs.

Even so, there are many who believe that one should optimise for petrol in dual-fuel operation and let the L.P.G. take care of itself - with one proviso. This is that one should not try to economise on the cost of the gas carburettor in the conversion kit. This component has potentially a greater influence on engine performance and economy than any practicable attention to the ignition system could have. It must therefore be a fairly sophisticated design to do its job properly.









One of the most significant features of the Citroën Visa with the 652 cc flat twin engine is its 'allumage électronique intégral' or fully integrated electronic ignition system. Citroën claim this is one of the most advanced ignition systems to be found on any European large-scale production car, representing a third generation' of ignition systems. The first was the coil and distributor, and the second the transistorized system now increasingly found in modern cars which retains a conventional distributor, with or without a rotor arm and breaker points, plus a centrifugal and vacuum automatic advance and retard mechanism.

The Visa AEI' system, developed by Citroën in conjunction with Thomson-CSF, differs in that it is completely electronic. Mechanical means of ensuring optimum spark timing have been eliminated, while the absence of a conventional distributor, which has been a feature of Citroën's flat-twin engines since 1948, has been further exploited. Earlier Citroën systems gave the spark plugs a hard life because they fired on every stroke, controlled by a contact breaker running off the nose of the crankshaft.

All mechanical systems suffer from the disadvantage that the higher the engine speed, the less efficient the timing, but fortunately voltage requirement decreases with speed, as does the time available to the coil to produce the necessary voltage.

Furthermore, the longer the interval between attention to the ignition system, the more the effect of wear in the mechanism reduces efficiency.

These problems are all eliminated in the Citroën equipment. A tiny on-board computer takes care of the ignition timing, ensuring much more precise control of ignition advance and retard and of the trigger controlling the primary angle, thus making certain that the coil can invariably supply the correct high tension current required by the spark plug irrespective of speed or load. Greater efficiency is thus obtained under all engine conditions, resulting in improved economy, good starting performance and low emissions.

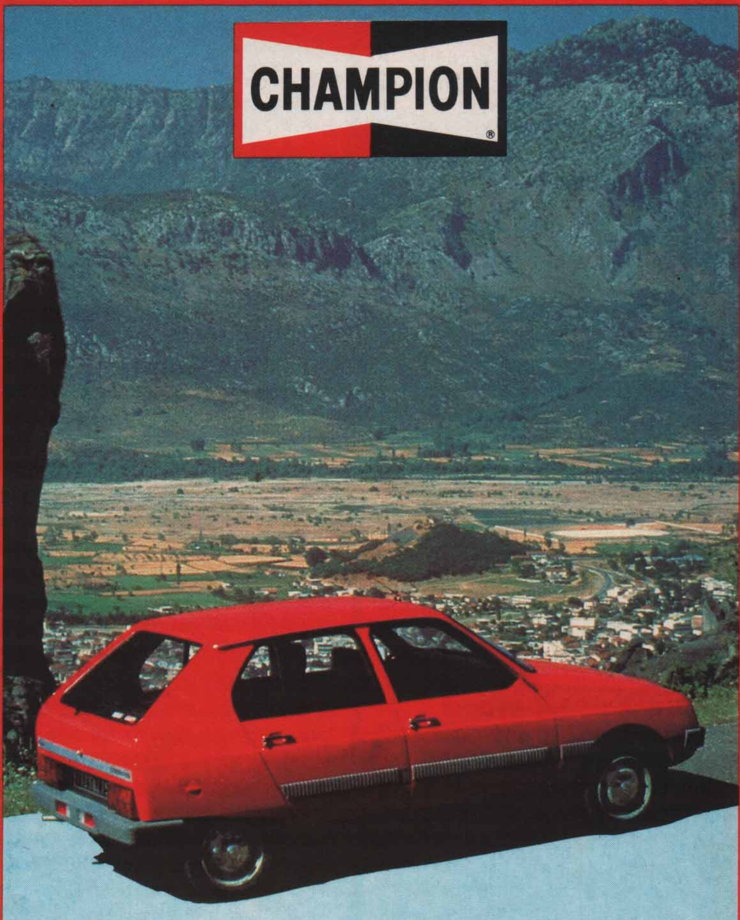
The method of obtaining a consistent output of high voltage from the coil in the Visa system differs only slightly from earlier Citroën transistorized ignition systems. Current input into the primary windings of the coil is controlled by an electronic module which also ensures that whatever the state of the battery, the input voltage is at the required optimum. It further controls the duration of the current flow to obtain the optimum high tension output from the secondary winding, thus avoiding the problems associated with varying dwell angles which are an inescapable disadvantage of the conventional mechanical system using a contact breaker.

But providing a constant supply of high voltage, in this case 30 kv compared with 15-20 kv available from the conventional system, is not in itself sufficient, even though it does mean easier starting at low temperatures or with a partially discharged battery. There is still the problem of making sure that the voltage available reaches the spark plug gap at precisely the right moment required by the engine.

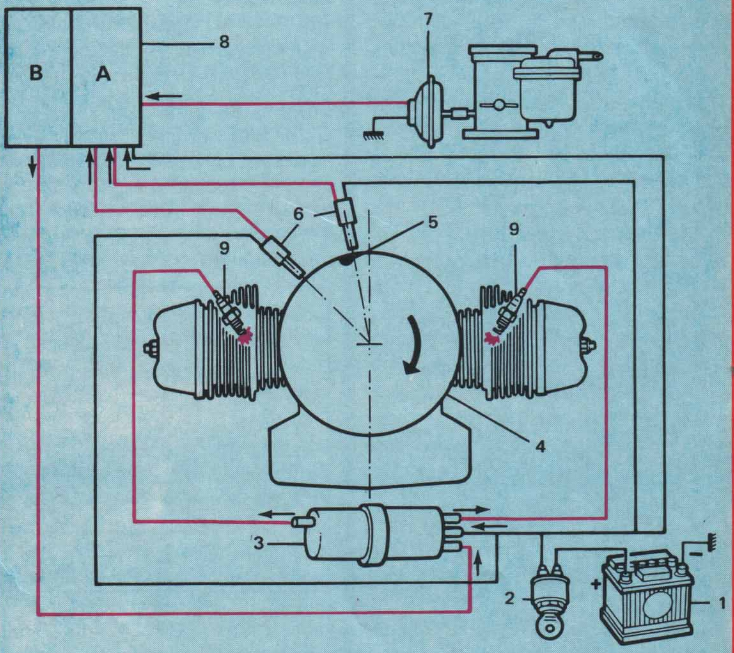
This is overcome by the mini-computer. It is triggered by a pair of magnetic proximity sensors attached to the clutch housing, receiving a pulse generated by a stud fixed to the flywheel. One sensor is located ten degrees before the TDC, and establishes the static advance point. The second is located 35 degrees before TDC and provides the maximum advance point. In addition there is a vacuum capsule measuring inlet manifold depression. This actuates a reed switch when induction vacuum falls below 150 MB, and engine speed exceeds 1050 rpm for more than a second, and advances the ignition timing by the required ten degrees.

Using signals received from these three sources the computer instantaneously adjusts the spark timing to the optimum demanded by the engine while at the same time controlling the flow of current through the primary winding of the coil. The advance curve precisely matches timing to engine speed, and the voltage available curve is maintained at a constant level of approximately 27 KV from a minimum speed of 10 rpm, irrespective of load.

Thus all adjustments and wear in the ignition system are eliminated, and the voltage available is sufficient to fire a cold engine turning over at only 10 rpm despite the use of wide plug gaps. And Champion BN-6Y are the only plugs standardized in the Visa with AEI.

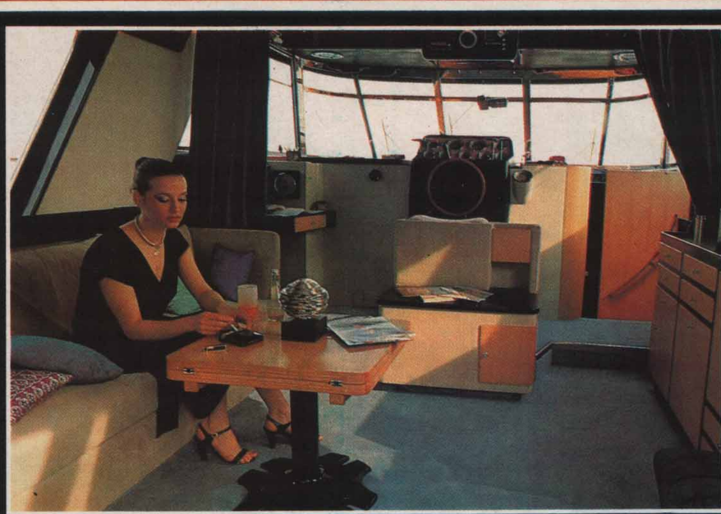


BN-6Y for AEI



1. Battery
2. Ignition switch
3. Ignition coil
4. Flywheel
5. Stud
6. Magnetic sensors
7. Inlet manifold vacuum sensor
8. Computer
   A. Signal generator
   B. Power generator
9. Spark plugs

They say at Riva that the arrival of glassfibre didn't come with any drama, but after a hundred years of traditional craftsmanship in wood, and with warehouses full of mahogany for seasoning, the change cannot have been easy. Even now, wooden-hulled boats are an important part of Riva's production but the supply can never satisfy the demand which exists. There is a shortage of young people who want to learn the skills of working in wood and Riva say that despite the high



cost of one of their wooden boats, it represents an investment because there is no way of increasing output to meet the demand. Like a Rolls, a mahogany Riva is an appreciating asset.

Based at Sarnico, on Lake Garda - Italy's largest lake - Riva have been making boats for three generations, culminating in the marriage of American power and Italian craftsmanship which today's Riva sportsboat epitomises.

The factory is very modern, with more workers than one would expect for the current level of production but this is explained by the fact that no less than 60 are engaged in the quality control of raw materials and manufacturing. Their task is to maintain the quality - not only of the fantastic Aquarama, with its superb fittings and eight handfinished coats of varnish covering its hand-built wooden hull, - but also the fibreglass hulls which are built to the standards which have made Riva's name a hallmark of quality.

Whether it is an off-shore craft like the 'St. Tropez' or '2000', or one of the more classic designs like the 'Portofino', 'Summertime', or 'Superamerica', there is always something special about a Riva design in terms of construction and fittings. Not least of its attractions is the fact that the boat always has a degree of adaptability in its design so that each can be 'personalised' to the exact requirements of its owner.

This is no doubt why Riva's list of customers reads like an international "Who's Who". Prince Rainier of Monaco, King Hussein of Jordan, Brigitte Bardot, Richard Burton and Jackie Stewart. They are all there, together with the handful of sheiks which forms a part of any such list of discriminating big spenders. Many major companies have a Riva to go with the corporate jet and the chairman's limousine.

How has a firm like Riva been able to survive, not only in the current world financial climate and - even more difficult - with its headquarters in the economically troubled Italy? The answer lies in the tradition set by the founder of the firm, Ernesto Riva, in 1860, and followed ever since. Riva boats are built with a meticulous eye to quality. By maintaining those standards of quality the company was able to make a smooth transition to powered craft when the internal combustion engine came on the scene. Riva have also used the area of power boat racing to publicise their products and thirty years of active competition have made sure that the name is known to potential customers and the general public alike. In this way the company has built up a brand image of quality and performance which has supported it in difficult times when other people in the business found it difficult to continue.

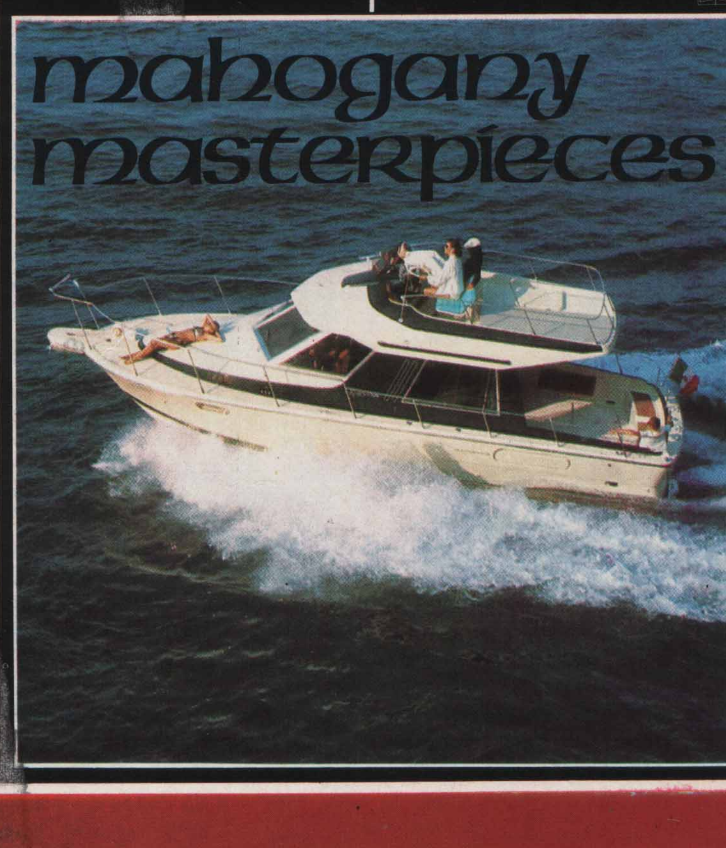
A big factor in the success of the Riva was the part played in its development by Carlo Riva, the nephew of the founder. After the war and in the fifties he reorganised the company after studying the American market. He saw the American scene as a preview of how Europe would develop and built up the company's production facilities to suit. He saw the opportunity to capitalise on the reputation of Italian quality and craftsmanship set by such names as Ferrari, Pininfarina and Gilera, and every boat produced by the firm was constructed to extremely high standards.

However, craftsmanship alone is not sufficient, and there must also be a sound business basis for any successful company. It was for this reason that 1969 saw an injection of American capital into Riva to provide the necessary financial security to underwrite future expansion.

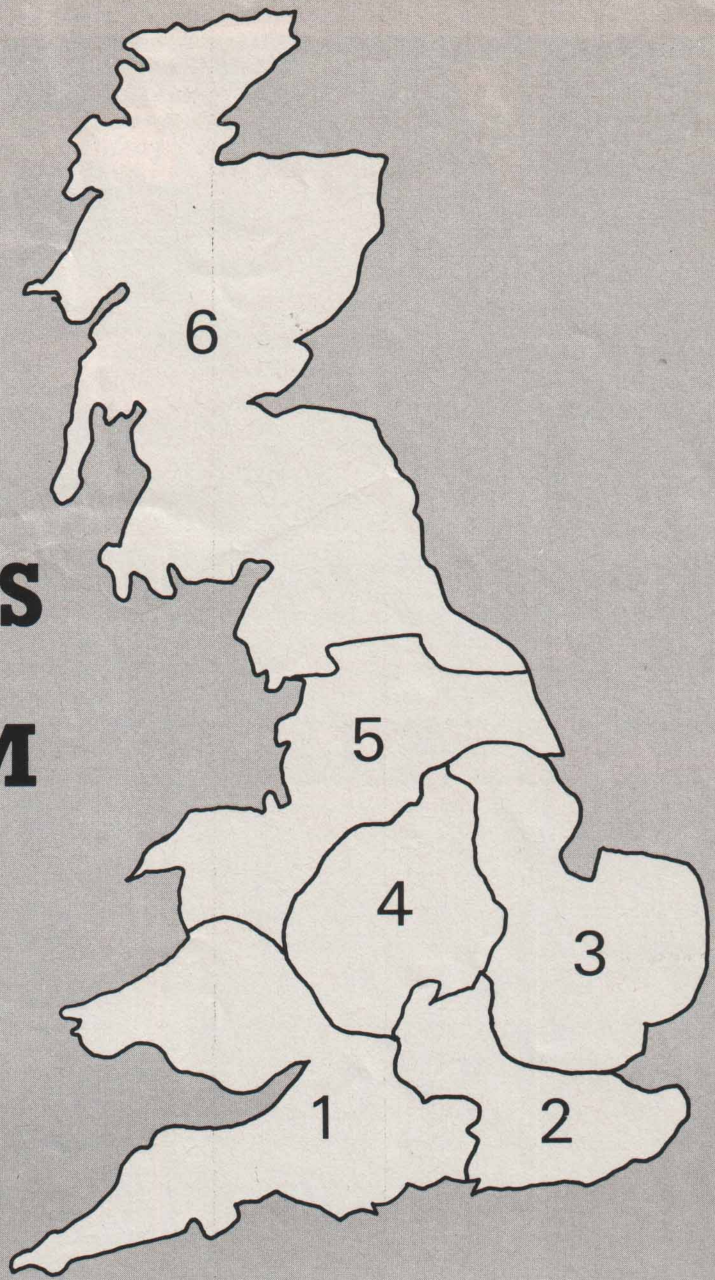
Now the Riva has taken its place among those status symbols whose names are immediately recognisable - products whose ownership sets a person aside as having not only wealth, but also taste. A measure of the importance of the name is the recent

announcement of a new magazine 'Symbol', which will circulate only amongst the owners of Rolls Royces, Ferraris, and Rivas. Probably somewhere amongst Motor Mail's wide readership there will be someone who is qualified to receive the magazine. If you are, maybe you could pass on your old copies to us here at 'Motor Mail' - unfortunately we're not on the mailing list.

mahogany masterpieces



CHAMPION'S NEW SALES TEAM




JIM HUGHES
GENERAL SALES
MANAGER


STEPHEN LEITCH
ASST. GENERAL SALES
MANAGER

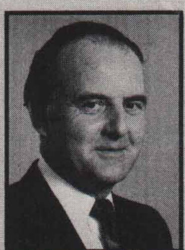
On 2nd July 1979, the Champion Spark Plug and Arman Wiper Products sales forces were combined to form the new integrated sales team charged with the responsibility of taking a major share of the U.K. wiper blade market whilst maintaining a tight grip on their dominant position as the world's number one spark plug company.

Under the leadership of Champion's General Sales Manager, Jim Hughes, supported by his management team, each man will now sell both spark plugs and wiper blades on newly re-organised sales territories.

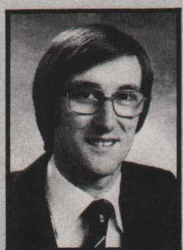
This will mean that you, our customer, will continue to receive the hardest hitting marketing support package ever in two of the aftermarket's fastest moving and most dynamic product areas.


ERIC WHYMAN
FIELD SALES MANAGER


JACK ASTLEY
SALES MANAGER
O.E./FLEET


COLSTON SUTTON
FIELD SALES
SUPERVISOR


LES CHISHOLM
FIELD SALES
SUPERVISOR


ALAN WATSON
SALES OFFICE
SUPERVISOR

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JOHN REYNOLDS


BOB EDWARDS


DAVID GOLDSWORTHY


TREVOR LOVESEY

NEW APPOINT-MENT

JOHN MATTHEWS


BOB RICHARDS


PETER WRIGHT

APPOINT-MENT IMMI-NENT


ROY SIMS


CHRIS BLOMFIELD


NICK BROWN


DOUG CURTIS


DAVID HALL

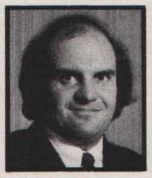

CHAS HOARE


DAVE MATTOCK


MICHAEL STOW

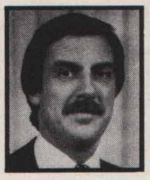

CHAS WADDELL


NOEL BIRKETT


BARRY CHAPMAN


BRIAN FRANKLIN


TONY MARTIN


GEOFF POTTS

APPOINT-MENT IMMI-NENT

APPOINT-MENT IMMI-NENT


TONY KEARLE


RAY BAUM


CHRIS CHAFE


REG GORDON


JOHN HEITZMAN


ALAN REECE


MARTIN WINSOR

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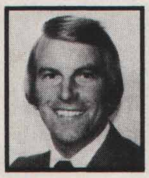
MAURICE CHAPMAN


MIKE BEAVAN


BARRY BELL


HAROLD GARNETT

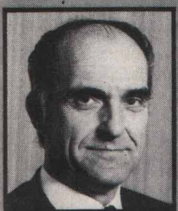
NEW APPOINT-MENT

PETER HARTINGDON


PHILLIP STAAL


ADRIAN WALKLEY

APPOINT-MENT IMMI-NENT


KEN McDONALD


OSSIE ARTHUR


DOUG JAMIESON


TOM MATTHEWS


RON MOWAT


BOB SIM


DENIS SCOTT

Beautiful Bodies

Many cities have their specialities, something which they are proud of, something they always refer to. Take Munich and its beer, for instance, Paris with its Haute Couture, or Florence with its art treasures.

Turin has a more modern art connotation - as the world centre of automobile design.

For those in the know, this is an established fact. For the rest of us, it becomes fairly obvious every second year - when the bi-annual Salone dell'Automobile takes place. That is when all the designers of the industry take a week off from their routine to have a look at what the artists in Turin propose for the coming year.

As with the fashion-shows of Paris, what is shown here is usually far out, impractical and too expensive to produce. But the ideas shown are usually what will be seen in production, modified to suit a conservative customer's sense of what is proper, of course. Give the motor industry a lead-time of eight to ten years, and today's Turin ideas will become realities.

It has been this way for the last 25 years. Before the war the carozzieri served the individual customer who bought a chassis and wanted it clothed after his (or his mistress') particular ideas. Came mass production techniques, and the industry forgot all about design and concentrated upon the technical solutions. The Italians saw an obvious market here, and developed their own modern skills in combining design and mass production. Result: A lot of American, European and Japanese cars had bodies, not only designed but also developed in Turin. And this is still the case. Even a factory like Rolls Royce asks Pininfarina to supply them with complete designs - including the structural part - for their bodies. And there is a lengthy list of bread-and-butter motoring companies using the Italian consultants.

But no one expects the Italian show-cars to ever reach production. They appear there to prove that the designers are still on the ball, still have fresh ideas, still know more about body-manufacturing and design than anyone else. The motor-show is their main advertisement, and their main customers are winging in from all over the world to take part in the extravaganza.

Here you meet Ford's Gene Bordinat jr., who has his own styling studio in Turin; the flamboyant Bill Mitchell, father of Chevrolet's Corvette; Volvo's Wilsgaard; Porsche's Lapin; Leyland's Bache - everyone in the trade, anonymous or very much in the public eye, mingling with the Pininfarinas, the Giugiaros, the Bertones, the Zagatos, sharing viewpoints and discussing trends.

Maybe it is not so strange that this is the car styling centre of the world. The Italians have always had a special feeling for cars which the rest of the world lacked. A motor-car has during its history in Italy always been a macho thing. But to compensate for the blatant machismo, they have sought to transfer female curves into the body design. Even their most muscular cars, like the old Ferrari Berlinettas, had obvious Lollobrigida-connections.

The Italians' sense of car-styling has always been very keenly developed. This, together with the Italian cars' reputation for being red and racy, has certainly attracted the dreamers among buyers. The Italians, and especially the Torinese, have been more than willing to supply both the dreams and the hardware.

Other countries have tried to compete. Once there were flourishing body-businesses in Germany, France, and Great Britain. But maybe they forgot the dream-part of it. In any case, most have disappeared.

Anyway, once every second year (next time it will be Spring, 1980) the Italian carozzieri are showing the world that there is still no alternative to their art. And the rest of the industry (together with gaping admirers from all over the world) will gather around the new dream-car and agree that the Italians' arrogant assumption is quite true. There is no alternative. And the proof will be obvious in eight years' time, when we all buy cars so unquestionably inspired by Turin some years ago.

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