

Alex Moulton and the Mini

Author's note: Throughout this presentation the word 'Mini' is taken to mean the classic Mini manufactured between 1959 and 2000. The information given here does not refer to the later MINI produced from 2001 onwards.

To understand Alex Moulton's contribution to the Mini, first we must understand a little about Alex Moulton as his background and character were inextricably bound up with his contribution to the 20th century's best car, according to Autocar magazine in 1999.

Alex (as he gave me permission to call him after I had left his employment, it was 'AM' or 'Dr Moulton' before then!) was a man of very high intelligence. He possessed supreme self confidence in professional matters and with his family background in rubber engineering he had the means to enact his new and radical ideas on vehicle suspensions. He was particularly fascinated by the motor car which as a young man he identified as the coming thing rather than the railway trucks which had made the family money until then. Rubber and indeed any kind of polymer natural or man made were still relatively new materials to engineering in the early 20th century, although Alex's predecessors had been manufacturing rubber components here in Bradford on Avon since 1848.

During the Second World War Alex worked as technical assistant to Sir Roy Fedden who was in Alex's words 'founder and boss' of the Bristol Aircraft Company engine division. When Sir Roy left Bristol's employment in 1943 Alex went with him and amongst wartime projects they worked on the design of the Fedden 'People's Car'. Conceived in the spirit of the pre-war German Volkswagen, the Fedden car had a rear mounted sleeve-valve radial engine and rubber suspension courtesy of Alex Moulton. One day in 1946 the single prototype 1Ex was being test driven in the Cotswolds by Alex's friend and engineer Ian Duncan when he had a meeting with another young man driving another strange looking car. This other young man proved to be Alec Issigonis of Morris Motors and his car was a prototype Morris Minor. Alec Issigonis was quoted as telling Moulton that as soon as he saw the prototype he knew that the Fedden car 'would be an enormous disaster'. Ian Duncan eventually left Fedden's employment and designed his own small car first shown in 1948 as the Duncan Dragonfly. This car was another highly advanced design featuring front wheel drive and rubber suspension designed once again by Alex Moulton. This time the world took notice and the Austin Motor Company bought the prototype and all Duncan's design rights. They then put the car into storage and hid it. Sometimes design ideas are simply too far ahead of industry's capability to absorb them..

In 1945 with his war work over Alex returned to Bradford on Avon and joined the development department of Spencer Moulton, the family firm. He became acquainted with the Fry family (of the chocolate dynasty) who lived nearby at Frenchay, particularly brothers David and Jeremy Fry who were around his age. Before the war the Frys, who were keen amateur engineers, had constructed a strange experimental rear engined racing car called the 'Freikaiserwagen'. Joe Fry a cousin was keen to re-establish international motor sport after the end of WW2 and drove a Lancia Aprilia in the 1946 Alpine Rally, the first such event held since 1939. The only other British competitor in that event was Betty Haig

daughter of Field Marshall Haig of WW1 infamy, driving an AC. In 1947 Jeremy, the younger of the two brothers designed and built another experimental racing car called the 'Parsenn'. The Fry family seemed to have a penchant for strangely named cars, and Alex was asked to design the suspension for this new car. He responded with an early version of what became the 'Flexitor' rubber suspension unit (Alex also liked names for his inventions) which used rubber in torsion and shear as its suspension medium. This gave the little racing car excellent grip and roadholding by the standards of its day.

Through the Frys, and probably not coincidentally, as Alex was always strategic about his friendships, Alex met Alec Issigonis during 1949. Issigonis was then in the ascendant at Morris having recently designed the revolutionary Morris Minor and with further schemes up his sleeve. During the late 1930s Issigonis and his friend George Dowson had also designed (and, it should be noted, built entirely by hand without the use of power tools) a highly innovative racing car called 'The Lightweight Special'. This car, intended for hillclimbs and sprints, was made from plywood faced with aluminium sheet and styled after the pre-war Mercedes Grand Prix cars which Issigonis had seen in action at the German Grand Prix of 1935. Amongst its many innovative features was a crude rubber suspension using rubber rings cut from inner tubes, much less sophisticated than Alex's design for the Parsenn. According to Alex's autobiography their meeting was cordial and they hit it off immediately 'having many shared interests'. Alex recalled that their first meeting, held in the dining room for senior managers in Morris's production plant at Cowley, Oxford, was 'quite bibulous with gin and tonics flowing'. What a wonderful turn of phrase and a sign of things to come..

Alex, who admired Issigonis immensely at that time, tried hard to get him to build a rubber suspended Morris Minor but Issigonis showed little enthusiasm for the idea. It was not until Issigonis left Cowley for Alvis in Coventry that Alex got his way. Issigonis's former deputy at Cowley, engineer Jack Daniels not only built a rubber suspended Morris Minor to Moulton's design, but also subjected it to 1000 miles of rough road testing at MIRA (the Motor Industry Research Association) near Nuneaton which it survived without any significant failures.

Issigonis moved to Alvis at Coventry during 1952 lured by the offer of designing a new large car from a 'fresh sheet of paper' and Alex wisely stayed in touch. Although by now working on rubber suspension systems for commercial vehicles Alex had yet to design a practical suspension system for a production car. Although Alvis was a small firm making expensive hand-built cars it was at least in the business of small scale series production which suited Alex's purpose, and so Issigonis and Moulton set to with a will. Having by now impressed Issigonis with the practicability of rubber suspension via the Morris Minor he was enthusiastic about a new suspension system for the Alvis car. Issigonis was convinced of the need for an interconnected suspension system in which front and rear springing units were connected on each side. He had patented a mechanical interconnected system back in 1949 whilst working for Morris. Working quickly, Moulton and Issigonis developed a system using two rubber springs back to back at each wheel with fluid interconnection between front and rear wheels at each side. This innovation gave firm springing, and with the new Alvis's long wheelbase a comfortable ride as the car rose and fell relatively gently over bumps rather than pitching. One prototype car was built and tested but the new model never reached production as Alvis simply didn't have the resources to fund such a radical design. However

valuable lessons had been learned by both Issigonis and Moulton. The project came to an end and Issigonis was recruited to head up a new design team for BMC the British Motor Corporation (recently formed from Austin, Morris and other associated companies) at Longbridge, Birmingham.

With Alex at a loss as to what to do next in his search for the perfect production car suspension, in July 1956 came the moment of divine intervention in the Mini story. Far away in Egypt Gamal Abdel Nasser, recently elected President of Egypt, decided that Britain, France and others had had it their way for too long and nationalized the Suez Canal. This move effectively stopped the flow of oil to the West and so plunged the world into not only a political crisis (the Suez Crisis) but also temporarily curtailed all motoring. Back in Birmingham Leonard Lord, Chairman of the newly formed British Motor Corporation demanded instant development action on a small and efficient car. Summoning Issigonis to his office at Longbridge in late 1956, Lord is reputed to have told him to 'design me a proper small car to knock all these bloody bubble cars off the road!' The bubble cars Lord was referring to were German made micro cars, often three wheelers with tiny two stroke engines. These vehicles were popular as they were very fuel efficient although mechanically crude. With time against him Issigonis re-established his favourite team and invited both Jack Daniels from Cowley and Alex Moulton to be part of it.

Much hyperbole and mis-fact (false news in today's language) has been uttered concerning the design process that produced the Mini (not least by Issigonis himself who saw no harm in making a good story even better) but the facts are indisputable. Starting from literally a blank sheet of paper in one of Issigonis's famous Arclight drawing pads in January 1957, a running prototype was approved for production by Leonard Lord on 19th July 1957 and the car went on sale to the public on 26th August 1959. By any standards in any era of motor car production that is phenomenally rapid for an all new car. With no comparable model in current production in 1957 (the Austin A35 was from a previous era) and using only the recently introduced BMC A series engine, the Mini came into being. The real predecessors of the Mini were those special experimental racing cars produced a decade and more before. They embodied the same free-thinking spirit and wholesale embrace of technological innovation that the Mini did. Issigonis denied that his Lightweight Special had any effect on the design of the Mini but a few minutes spent looking at this wonderful car (which is in the care of the British Motor Museum at Gaydon, Warwickshire) will tell you that that simply isn't true. The ingenuity and economy of the Lightweight Special are echoed in the Mini. In the case of the Mini Issigonis had been hatching a tiny 'charwoman's car' for years and he simply sat down and drew out the complete car from his head in more or less finished form. A fantastic piece of inspirational design. The extremely efficient packaging of the new car (the fitting of necessary components into the overall envelope of the car) created a very large passenger space capable of accommodating four adults plus their luggage in a car only 10 ft (2.54m) long. However this left a tiny space for the suspension which gave Alex Moulton and his team a distinct challenge. A conventional solution simply wasn't possible as there was not enough space for one, and anyway Issigonis and Moulton were hardly about to put anything conventional into their radical new baby car! Alex was much more of an iterative designer than Issigonis but he already had the beginnings of a solution to the Mini's miniature suspension in his work on the fluid interconnection of rubber suspension systems begun during the Alvis project. He and his team worked at the problem, miniaturising their

system until they had produced a tiny rubber 'tea cup' suspension cone which with a bit of draughtsman Jack Daniels' magic could just be fitted into the space available in the new Mini's steel subframes. Holes had to be cut in the front and rear of the suspension towers in the front subframe to accommodate the suspension units, a solution that came to Jack Daniels in a dream! Moulton wanted to use fluid interconnection between his tiny rubber springs but there simply wasn't time within the new car's lightening development period to engineer this properly. Launch of the Mini without an interconnected suspension system was therefore decided upon in May 1958.

Both Moulton and Issigonis are on record as saying that during the Mini's development they were primarily concerned about safety. They were worried that such a small car with four passengers and luggage aboard might display very different handling characteristics to that which it exhibited with only the driver inside it. They wanted to make it as safe as they could for the ordinary person to drive in all conditions. The outstanding handling and phenomenal grip on the road that the new car displayed even in prototype form surprised its designers. According to Alex Moulton the Mini's roadholding was better than he and Issigonis had dared hope for. Somehow Issigonis and Moulton had got it right, first time. Once the suspension was designed and installed in a prototype car very little further development was done and the basics of the Mini's suspension remained the same from launch in 1959 to the end of its production life in 2000.

Hidden within the Mini's very short development phase was an important design principle that ensured its success and longevity. Right from the beginning Issigonis, Moulton and the other team members designed their little car to be driven by anyone. Literally anyone of driving age and capability in Britain could drive a Mini. That is not as obvious an idea as it seems today, 60 years ago private cars in Britain had until very recently been owned and driven exclusively by the wealthy and privileged. Many of the older models were big and heavy making them hard for women to drive. In 1959 for the first time over 30% of households in Britain owned a car and that number was growing fast. Alex Moulton was from a privileged background and was of a conservative disposition, so in a similar way was Alec Issigonis although he described himself as being 'uninterested in politics'. When it came to their work however they were both firmly egalitarian in their outlook and in that they were totally in tune with their times. For Issigonis and Moulton science and engineering held the key to a better life for all people and they enacted this principle without hesitation and without compromise.

The 1960s were just around the corner and during that decade British society changed with class divides eroding and young people gaining a lot more economic and political power. Against this background the new innovative compact British people's car flourished and the word 'Mini' became one of the words of the new decade. Mini-skirts were just the start with miniaturization becoming one of the fads of the 1960s.

On 26th August 1959, the August Bank Holiday for that year, the Mini (initially badged either the Austin Seven or Morris Mini-Minor) was launched. The educated motoring Press loved it and many glowing reviews were printed by journalists from all around the world. In particular the little car's roadholding and handling was widely praised and Alex Moulton had every reason to feel proud of himself and of his team.

The Mini's commercial life was not without its teething troubles however. The British motoring public of 1959 were largely conservative in attitude and did not rush to buy BMC's new wonder car. The average car buyers were suspicious of the new car's technical complexity, they reputedly didn't like the austerity of its interior (austerity having been an unwelcome necessity of the Second World War years) and worse still it didn't look like other cars! During the last months of 1959 and into 1960 sales were sluggish and BMC management held their breath. The early cars displayed an alarming array of faults some serious (fragile transmission and non-existent brakes), some annoying (early cars simply filled with water during heavy rain) and some trivial (complaints were made that passengers who wanted to smoke in the back of the car couldn't reach the ashtrays). All were patiently fixed by Jack Daniels and his team who at one stage had 51 separate faults to deal with on cars already in volume production! It would be fair to say that the early buyers of the Mini helped develop their own cars, a situation that couldn't possibly happen today Or could it?

Slowly sales of the Mini picked up assisted by an astute piece of product placement on behalf of Alec Issigonis who managed to give a Mini to the newly married and highly fashionable Princess Margaret. Her husband, Lord Snowden was a personal friend of Issigonis via the same Fry family who had introduced him to Alex Moulton. This worked out brilliantly as Margaret and Tony (as they were known) appealed not only to the royalists amongst the older British population but also to the up and coming motorists, the younger generation. Known for their fashionability, unconventionality and love of a good time the new young Royal couple would become icons of cool Britain during the 1960s. Suddenly, almost overnight the Mini was the car to be seen in. Pop stars and film stars, celebrities of all types suddenly had to own a Mini and so did the general public. With the car now much improved sales literally took off. From an initial run of 19,749 cars produced in 1959 the annual production of the Mini rose through 116,677 in 1960, 157,059 in 1961 and 216,087 in 1962. Production stayed above 200,000 per annum from 1962 to 1977 peaking at 318,475 cars built in 1971 and finally ceased with just 7070 cars built during the year 2000.

Buoyed up by success BMC introduced many new versions of the Mini extending the range. The MiniVan (1960) was a delightful tiny van with even better handling than the Mini saloon as it had a longer wheelbase and as it didn't attract purchase tax (due to being a commercial vehicle) it became a very popular first car amongst the young. My father, a junior doctor at the time, swapped his much loved Lambretta for a MiniVan and never looked back (which was just as well as I was born the next year). Along came also the Mini Pickup (1961), the half timbered Austin Mini Countryman or Morris Mini Traveller (1960) and the bizarre Riley Elf and Wolseley Hornet (1961), which Issigonis and Moulton must surely have hated as they represented the elevation of marketing appeal over engineering. Finally the Mini Cooper (1961) and Mini Cooper S (1963) brought the Mini to prominence on the racing circuits and rally stages of what was now a world market.

Both Moulton and Issigonis rode on the wave of success that the now successful Mini bought in its wake. Development meetings between the two and others including Charles Griffin, John Cooper of the Cooper Car Company who lent his family name to the Mini Cooper and Daniel Richmond of engine tuning experts Downton Engineering took place

regularly in the Midlands. Sometimes the core team of Issigonis and Moulton plus a few friends would meet in Monte Carlo a lovely place to visit especially in the middle of winter, but hardly the most cost-effective location for development meetings!

But what of the Mini's suspension? In the background to all of this excitement, and in parallel with the development of the Moulton Bicycle which was by then taking place, Alex Moulton found time to continue work on the Mini's suspension development. His dream of 1957/58 had been to launch the Mini with fluid interconnected suspension but that system still in development had to wait until 1962 to meet the public in another vehicle. The new Morris 1100 which was beautifully styled by Pininfarina rather than Issigonis had grown-up mid-market appeal and became Britain's best selling car of the early 1960s. The 1100 had patented Moulton 'Hydrolastic' suspension from the outset and as a result exhibited that strange bouncy ride that BMC cars came to be known for during the 1960s. A miniature Mini version of Hydrolastic finally arrived in September 1964 and from then until 1971 all Mini saloons produced used this system. It gave the Mini a more sophisticated ride at the expense of its fore and aft attitude which, particularly in the higher powered Mini Coopers, could be manipulated by an enthusiastic driver. As a result of this Moulton Developments produced a selection of stiffer Hydrolastic 'springs' for the Mini Cooper S which worked better with the larger and heavier 1275cc engine with which the car was optionally fitted from February 1964.

Alex Moulton was very proud of the Hydrolastic system he designed for the Mini, regularly reminding people that most of the factory team's rally victories with Mini Coopers were won by cars fitted with his interconnected system. The truth is that the constant engine and transmission development of the Mini Cooper S during the mid 1960s had at least as much to do with the car's rally successes as its fluid suspension system. The deletion of Hydrolastic from the Mini range (with the exception of the Mini Cooper S which retained it until production ceased) in 1971 and the return to the 'dry' rubber cone system was prompted by economics rather than by any fault in the suspension system. Hydrolastic was too expensive for a cheap people's car.

As the 1960s turned to the 1970s Issigonis retired and was knighted. BMC became British Leyland or BL under the chairmanship of Sir Donald Stokes, a very different personality from Leonard Lord who had retired in 1961 or his former deputy the mild mannered Sir George Harriman who had succeeded him. Alex Moulton had a business to run and contracts with Dunlop (who made his suspension units) and BL to honour and so he got on with the job of developing further car suspension systems for them. This irritated Issigonis who felt that Moulton should have 'retired' from business with BL out of loyalty to himself and the two never spoke again.

Alex Moulton developed the gas and fluid sprung system 'Hydragas' which debuted with the Austin Allegro (1973) and was also fitted to the Austin Metro (1979) (although unconnected) and to the MGF(1995) amongst many other models. The Mini was never fitted with Hydragas as a production item although several prototypes based on Minis and fitted with experimental Hydragas sets ups were made by Moulton Developments. Alex also designed and introduced the 'long cone' for the dry rubber suspended Mini as part of the 'Smootha-ride' system. As the car put on weight over the years the original rubber cones became

inadequate hence the redesign. This system is now sold by specialists MiniSport as an upgrade on the original system for later Minis.

During the 1990s the Mini finally came to the end of its life as a production car. Sales were down to a few thousand cars per year and incoming vehicle safety legislation made it impossible for the Mini to continue to be sold as a new car. Alex Moulton worked with Rover engineers on an experimental replacement vehicle, the 'Minki' which featured a Hydragas system. The experiment came to nothing however as BMW, the new owners of the MINI brand, went their own way and produced a conventionally sprung hatchback with superficial Mini styling. Alex hated it on sight describing it to me as 'an armoured car' but ironically the new MINI has proved to be a strong seller and its development continues.

With sixty years hindsight, and hindsight 'is a wonderful thing' according to that other great Englishman William Blake, Alex Moulton's part in the gestation of the Mini can be seen in its proper context. Having grown up with the Mini I can tell you that it was one of the truly great designs of the 20th century. It played a large part in my early life, and in the lives of my parents as it did in the lives of many other people in Britain and all over the world. The Mini gave people affordable, relatively safe mobility and a great deal of fun.

As I said at the start Alex Moulton was a highly inventive and intelligent man. He acted from the best motives, of furthering science and engineering, of keeping his business which employed many local people going and of maintaining The Hall in which we are now sitting in good condition. He should be remembered and honoured for a lifetime of actions in those causes, and the Mini was one of the best of those actions.

I leave that last words of this presentation to Alex himself. I interviewed him in July 2012 in the dining room of The Hall not far from where we are now. He was not in good health and he passed away in December that year. However he said to me 'The best testament to the Mini is that people, particularly young people are happy to drive the car and to be seen in it. It is still in fashion after nearly 60 years, that's wonderful'.

Thank you

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