An Electric Triumph

Natalie Michaels[1]

[1] Associate Professor at Belmont University

Abstract: Can a Triumph Spitfire perform better without the engine, radiator, petrol tank, or exhaust system? Absolutely! In 1992, Rick Michaels completed his conversion of a 1979 Triumph Spitfire, making this the very first fully electric 1970's sports car, that maintained the car's looks and speed. His work was innovative, and ground breaking. This is his story.

Keywords: electric, triumph, spitfire.

I. INTRODUCTION

When I asked my husband how he created the Electric Triumph Spitfire sitting in Lane Motor Museum in Nashville Tennessee, he answered that he took the vendiculartriquad, and reversed it with the centiminial aspirator. Knowing that I knew nothing about cars, he figured I would just nod my head, and say, "Well, that's cool." He was right! That's exactly what I said. Don't get me wrong, I'm a smart woman, but he was correct in his assumption that I knew nothing about cars. Nonetheless, I never lost sight of the ingenuity of his creation. I was incredibly impressed. When I asked why he created this car, he shrugged and said, "I was hopeful that this would be incentive for the industry to create vehicles with little to no emissions. Commuting to work and back in the 80s, in Los Angeles from Van Nuys to Gardenia, I couldn't help but notice the thick smog from the cars and smoke stacks. It made it hard to see and on certain day, hard to breathe. There's an old saying, that if you don't like something, you can either ignore it, accept it, or change it. I was hoping to change it."

So, in 1992, Rick Michaels took a 1978 Triumph spitfire and made a fully electric car in his garage without sacrificing any of the inherent characteristics of the original spitfire, except for the missing exhaust system, and a quieter ride. Although this may be past news, his ideas helped set the trend for more innovative ideas in greener auto engineering. Richard Truett (1992, p G-8) wrote, "A close look at the professional way Michaels conceived and carried out the restoration and conversion of his Spitfire would probably be enough to silence most critics. If not, a test drive likely would."

II. SYSTEM MODEL

When looking at the car, it appears to be a beautiful red Triumph Spitfire, with nothing added or taken away. only giveaway is the missing exhaust system, and the license plate that says "Not Gas". When you open the door for the gas tank, there is a shocker… an electric cord (Figure A). Yet nothing is as shocking as the quiet ride; the only thing that Michaels varied from the car's original features. As a quick overview, Michaels removed the old Triumph engine and installed a high performance electric motor, eliminating the need for the exhaust system, oil tank, and radiator. Those were therefore removed as well. He was careful to preserve as much of the car's original features as possible, making the ride smooth and effortless, but in a very classy chassis. His inspiration was simply to drive a vehicle that was not contributing to the already dense air pollution he encountered each day on this long commute to work.

Figure A. Inside the gas tank, a low-volt plug

III. PREVIOUS WORK/BACKGROUND

Auto Emissions

Sources of air pollution from vehicles on the road include ozone, air toxins, and particle pollution (EP, 2017). Congress passed the Clean Air Act in 1970, and there has been some improvement. Although Carbon monoxide levels were not significantly lower in 2014 than in 1990, the levels did stop increasing, possibly due to the standards enforced through the Clean Air Act, or possibly in-part due to the increase in hybrids and electric cars on the road. Regardless, when Rick Michaels began contemplating about the conversion of a gas operated vehicle to electric, it was because of the intense smog in the LA area, and his stated wish to "do my part." Now, its just a really cool car!

Prior Electric Vehicles

Prior to Michaels' antics in the garage, there were very few documented cases of automotive electric conversion, yet the history of the electric vehicle is a long one. In the 1700's, the first self-propelled vehicles relied on steam. This was not terribly efficient, especially in cold weather when it could take a great deal of time to warm up the vehicle (Matulka, 2014). Sometime in the 1830's, Robert Anderson, a Scottish inventor created the very first electric-powered carriage using a non-rechargeable battery known as a primary cell (UPS, 2017). William Morrison further sparked interest in electric vehicles when his electric carriage debuted in the United States in 1890 (Matulka, 2014), and in 1986, with the help of Pedro Salom, his Electrobat became more street worthy with pneumatic tires and lighter materials (Wilson, 2016). By the year 1900, although most vehicles were still horse-driven, about a third of all vehicles on the road were electric, including a small fleet of taxis in New York City (Matulka, 2014; Wilson, 2016). Gasoline powered cars were now available due to improvements in the internal combustion engine, but they were noisy with unpleasant smelling exhaust, and they required a lot of effort to use, including a hand crank that when done improperly could lead to injury. There is even a wrist fracture named after this, the "Chauffer Fracture," or Hutchington's fracture of the distal radius with a separation of the radial styloid (Payne, 2016). Although electric car didn't have any of the issues associated with gasoline driven vehicles, Henry Ford's introduction of the affordable, mass produced Model-T in 1908 drove electric cars off the road. Charles Kettering invented the first electric starter in Cadillacs in 1912, eliminating the need for the hand crank, further igniting the drive for gasoline-powered vehicles (Britannica, 2017). Although the Detroit Electric was considered to be a good car in 1923, the Model-T was about one-third the price, and plowed over this competition (Wilson, 2016). Soon, the electric car would be replaced by gas-driven vehicles. The documented research after this point becomes a bit sparse. Rebecca Metulka, a former digital communications specialist for the energy department reports that these were "a sort of dark ages with little advancement in the technology…" (Metulka, 2014). Jumping ahead to 1971, when the Apollo 15 mission used a fully electric land rover on the moon. This technology was ground breaking. Then, in 1976, oil shortages led to a Congressional decision to pass the Electric and Hybrid Vehicle Research Development and Demonstration Act supporting research and development of electric vehicles, but the vehicles produced at this time typically had lower performance, shorter distance of travel, and low speeds, topping out at only about 45 miles per hour. The EV-1 was produced by GM in 1990, and this car did have excellent performance, but production ceased in 2001, some say due to high cost (Metulka, 2014), and others say due to a recall from electrical fires (Adams, 2001).

Whatever the case, Rick Michaels had converted his gas-powered sports car into a high performance, fully electric vehicle, in his garage in 1992. He was on Good Morning America, and met Al Gore at the Nickelodeon World Council: Plan it for the Planet Energy Fair. Yet, somehow, his car was left out of this historical account. The introduction of the first mass produced hybrid, the Toyota Prius, did not happen until 1998, and then Tesla vehicles in 2006, followed by the Chevy Volt in 2010. As of 2014, there were 46 hybrid, and 23 plug in electric vehicles available, with public charging stations installed across the country, funded through the Energy Department's Recovery Act. According to Cobb (2017), there are 2 million electric cars on the road world-wide today. Although the creation of the Michaels' Spitfire was not mentioned in these historical accounts, and although many may have borrowed his ideas (garnered from his presentations in the early 90s), his methods were never fully documented, until now.

Justification / An Idea from Thin Air

Although the reason Michaels felt driven to build his electric vehicle has been previously stated in the paper (the LA smog), his personal account helps to really understand this quest.

I believe it was 1985, I was a field tech in Los Angeles on the Santa Monica Freeway which runs west, I was trying to go north on the San Diego freeway, but accidently got stuck in the left lane, going south. Traffic was stopped, and my boss was paging me, with no cell phones back in the day. The ramp I was on was very high, possibly around 8 to 10 stories off the ground and you could look down and see the thousands of cars just sitting there. I could also see the smoke stacks from the nearby refineries. I'm sitting there and choking from the smoke, and this got me thinking, that this is ridiculous. It's the 20th century and we're living like this. It's just so wrong, there's got to be a better way. The only problem with the creation of fully electric vehicles would be that electric car building plants would also create smog, but that would be one point-of-failure versus the current situation with hundreds of thousands of cars, each creating its own pollution. I had to try to build a fully electric car that would not lose any of the power and distance that we need in modern day society. I originally thought of using magnetics to replace the combustion chambers but this probably wouldn't work. Then I thought I would just use a large series-wound motor, a big one and put batteries in it and try to find a controller to replace the carburetor. Anyway, it just stuck in my head for a couple of years until I wrote it down, and began planning, researching at the library, and re-writing. I later moved to Florida and began to build the car in my garage in 1990. So anyway, that's why I started building it to see if it could be done, and it worked out.

IV. METHODOLOGY

The following is an overview of the procedure Michaels took to create his fully electric Triumph. This is not in any way meant to be a how-to manual. This is only a brief depiction of how Michaels performed his conversion in his garage with the tools available in the early 1990's, on a vehicle built in the 1970s. It goes without saying that skilled mechanics who choose to perform a gas-to-electric conversion on a vehicle, should make sure they have a good, clear understanding of the mechanics of the make, model, and year of the vehicle being used for the conversion. Before trying this, it might be prudent to contact Rick Michaels for clarification of his methodology, and to also perform one's own valid research.

Stripping the Car

The first step was to find a car that could be stripped down easily. Michaels chose the Spitfire because of the easily accessible motor, and because he knew the car well having worked on one as a teenager. He first removed all the internal combustion parts, the engine, then the radiator, cooling system, carburetor, starter, and exhaust. From the transmission back, everything stayed original, from the transmission forward, everything was stripped. He pulled all this out of the car, but maintained the original drive train.

Figure B. Ten 12-volt batteries

Creating the Conversion

Michaels made sure that the height of the transmission in the car remained the same so that the modifications wouldn't disrupt the flow of the transmission lubrication. He then attached an electric 58 H.P. maximum output, Advanced D.C. motorto the transmission. He put in ten 12-volt, deep cycle batteries; 4 in the front, and 6 in the back (in the trunk) (Figure B). Another 12-volt auxiliary battery is located near the transmission to power the wipers, radio, head-lights. This maintains the original low-voltage electrical system. A DC to DC converter was used to step-down the 120-volt system to 12 volts allowing for operation of the low voltage components and recharging of the auxiliary battery without the use of an alternator.

Method of Acceleration

Because the carburetor was removed, a method of acceleration was needed. For this, Michaels replaced the accelerator pedal with a potentiometer.

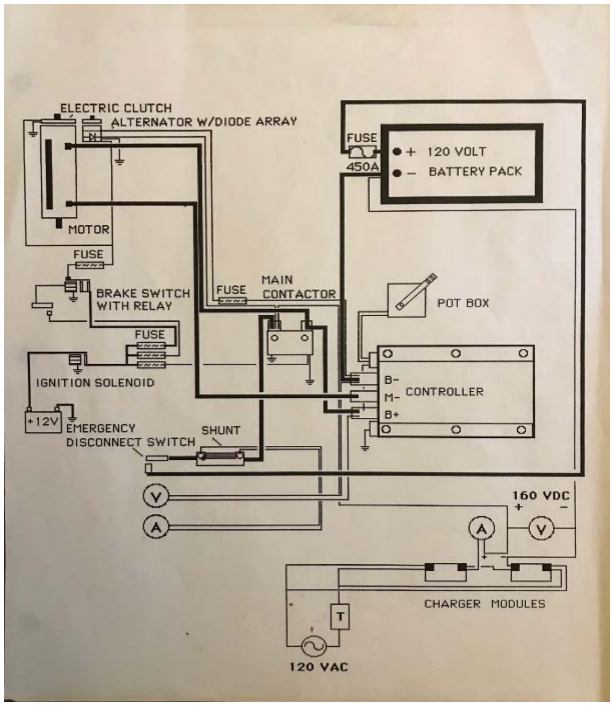

Figure C. Schmatic

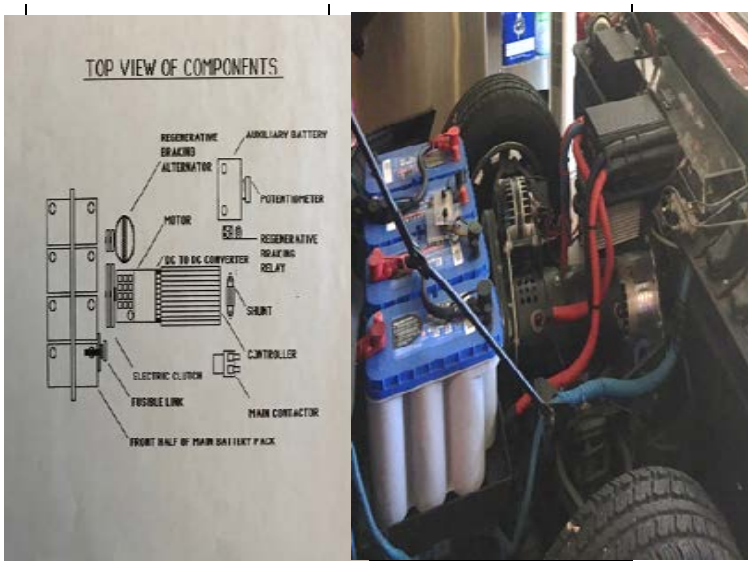

Figure D. Top view of components

He then took the cable from the potentiometer, and ran it through the veritable resistor to a pulse-width modulation controller (Figures C and D). This is a transistorized, solid-state, pulse-width modulation controller weighing about 16 pounds. Pulse-width modulation refers to the ability to make a motor "think" less voltage is being utilized by quickly turning the current off and on, resulting in an "average" instead of the total number of volts. The controller Michaels used turns the current on and off about 2000 times per second.

Regeneration Breaking

A portion of the electricity it takes to go up a hill can be restored to the batteries coming back down that same hill using regenerative breaking. Regenerative breaking is in place using a relay to supply power to the alternator, converting the mechanical energy to electrical energy before the mechanical breaks engage. The electric clutch will only attach to the drive train if the brake pedal is pressed. This turns the alternator, enabling the alternator to generate electricity, trickle charging the main battery pack, getting back a portion of the main power used to accelerate the car.

Figure E. The Gauges

The Tachometer

The tachometer tells revolutions per minute (RPM). In an internal combustion engine, most tachometers take pulses from the coil in the engine. Michaels wanted to keep the gages original (Figure E), however, but there were no available conversion kits on the market at the time, so he needed to be creative. He took an emitter detector circuit, and put it into the bell housing, leaving the original fly wheel and adding two reflectors. Now, every time the motor goes around it clocks a reflection, that emits a pulse converted by a small computer, translating the RPMs to the tachometer.

Recharging

There are two ways to charge the car. There is a low-volt on-board charging system using a 110 charging cord, which would charge the car overnight. There's also an external, off board-charger using 220 volts which charges the car much faster, and that plugs into a separate cord.

V. RESULTS

The result of this love of labor was a truly innovative, fully electric car with the original drive train, and without the noise of the typical Triumph Spitfire. Rick Truett (1992) challenged any critic to scoff at the endeavors of this motor-minded fiend. He reported that one drive in this car would put these concerns to rest. Who in their right mind would ever think of converting an already cool car. To Michaels it was a cool car, but no car is completely awesome, until it's clean. He is very happy about today's hybrids which lower emissions while keeping many of a car's original features, preserving jobs as well as air quality.

Figure F. Then and now.

VI. CONCLUSION

Being forever humble, Michaels states that, "All I did was take existing technology, and built a sexy, electric car out of it. Back in the day, existing electric vehicles didn't look all that sexy and they were slow. But when you take a sports car, that runs well, and you don't even know that its electric. It makes a big difference." It is estimated that there are 2-million plug-in vehicles on the road world-wide, but there are also 1.4 billion automobiles on the

road world-wide, this means that plug-in vehicles only constitute 0.14 % of the total number of vehicles on the road world-wide. Still Cobb (2017) believes this is "a significant drop in the bucket." How much the work of Rick Michaels contributed to this trend is unclear, but as stated so eloquently (and humbly) by Michaels, "It takes the cumulative ideas of hundreds of people to create something that works in our society to make the world a better, healthier, place." And… the car still runs great!

ACKNOWLEDGEMENTS

Rick Michaels would like to personally thank Solar Car and the employees in 1992 who made suggestions for some of the auto parts used in this endeavor.

REFERENCES

[1] Adams (2001). Why is GM crushing their EV-1s? Te continuing fight against the California ZEV mandate. ElectrifyingTimes.Retrieved.http://electrifyingtimes.com/ev1crush.html

[2] Britannica (2017). Charles F. Kettering: American Engineer. Encyclopedia Britannica. Retrieved.https://www.britannica.com/biography/Charles-F-Kettering

[3] Cobb, J. (2017). The world just bought its two-millionth vehicle. Hybrid Cars, January 16, 2017.Retrieved. http://www.hybridcars.com/the-world-just-bought-its-two-millionth-plug-in-car/

[4] EPA (2014). U.S. Greenhouse Gas Inventory Report. United States Environmental Protection Agency.Retrieved.https://www.epa.gov/ghgemissions/us-greenhouse-gas-inventory-report-1990-2014

[5] EPA (2015). History of reducing air pollution from transportation in the United States (U.S.) United States Environmental Protection Agency.Retrieved. https://www.epa.gov/air-pollution-transportation/accomplishments-and-success-air-pollution-transportation

[6] EPA (2017). Transportation, air pollution, and climate change. United States Environmental ProtectionAgency.Retrieved.https://19january2017snapshot.epa.gov/air-pollution-transportation_.html

[7] Matulka, R. (2014). History of the Electric Car. United States Department of Energy. Retrieved. https://energy.gov/articles/history-electric-car

[8] Payne, J. (2016). Wrist Fractures.Orthopaedics and Sports Medicine. Retrieved. http://www.patient.co.uk/doctor/wrist-fractures

[9] Truett, R. (1992). It looks like a Spitfire, Drives like a Spitfire.... The Orlando Sentinel, July 23, 1992. G-1,

[10] UPS (2017). Robert Anderson (19th century Scottish inventor). UPS Battery Center. Retrieved. http://www.upsbatterycenter.com/blog/robert-anderson-19th-century-scottish-inventor/

[11] Wilson, K.A. (2016). A brief history of the electric car: 1830 to present. Car and Driver Magazine.Retrievedhttps://www.caranddriver.com/flipbook/worth-the-watt-a-brief-history-of-the-electric-car-1830-to-present

About the Author:Natalie N. Michaels, PT, EdD, GCS Emeritus is a Physical Therapist and an Associate Professor in the Occupational Therapy and Physical Therapy Departments at Belmont University, College of Health Sciences. She has authored or co-authored over 20 peer-reviewed articles in her field, and is married to Rick Michaels, Telecommunications Engineer with Asurion, and the creator of the Michaels' Triumph.

Dr. Natalie Michaels is the corresponding author. She can be reached at 615-604-3727, natalie.michaels@belmont.edu