The Stu & Stanley Story

The story of the building of a Stanley Steamer

by Stu Martyn

This story actually starts some ten years ago. I had always wanted to own and operate my own steam driven automobile but got somewhat sidetracked by well meaning friends into building a half scale Wallis and Steevens steam tractor (AME May-June 2002, issue 102), a 5 inch scale loco (AME May-June 2005, issue120), a small hit and miss petrol engine (AME Jan-Feb 2003, issue 106) and numerous other small working steam "toys".

Operating the tractor, given its complete freedom to roam, was great fun as long as one didn't mind manually feeding its insatiable appetite for fuel and putting up with the discomfort to the vertebrae caused by its basic and primitive suspension. The loco certainly was comfortable to operate but I soon became bored going round and round the same track and I learnt the true meaning of the old Army expression of "hurry up and wait". I wanted, no, craved for a steam driven car. The luxury of inflatable tyres, sprung chassis, padded upholstery, the complete freedom to travel just about anywhere as long as these wanderings were within a club's boundary so as to remain under the insurance umbrella. Oh what Joy! The only steam cars I had ever heard of were the Stanleys. Knowledge of other steam car manufactures such as Doble and White and other early European designs came later. I was somewhat surprised that the U.K. never produced a steam car even though the Poms have written enough on the subject. The photo of Bert Francis's two thirds scale Stanley in AME July-August 1997, issue 73 got my full and undivided attention. That's the car I wanted!

Certain friends again tried to divert my plans by introducing me to a bloke who had successfully converted a Volkswagen Golf to steam. He had blanked off two cylinders and fitted the other two with poppet valves and powered the whole schebang by flash steam. Procrastination set in until I spied Kevin Hyde's beautiful Stanley in AME Jan-Feb 2000, issue 88. Decision made! I contacted the Editor of AME, Dave Proctor (thanks mate), who provided contact details. After many telephone conversations and correspondence with Kevin (who unfortunately lived on the other side of Australia in NSW) I accumulated enough information to commence my replica/model of a 1904 Stanley Steamer. Without the wealth of information which included photos and hand drawn sketches provided by Kevin this project would never have seen the light of day. I was never fortunate enough to meet Kevin personally, he passed away in May 2005 and I should like to dedicate this article to him. Our last telephone conversation was in December 2004, Boxing Day, when I rang to inform him that my Stanley was in steam and up and running. 1904-2004 one hundred years on.

Diff. asembly. Note anodised aluminium reach rods. Original were oak — torsional type damping.

In his first letter to me (5 Dec 2003) Kevin answered my initial enquiries. He agreed that LPG was the way to go and suggested that a boiler built to the AMBSC would be much better than flash steam because of the problems associated with corrosion and control. In his words "LPG is the way to go for heat. You say one third full size — as the Stanley was only a small car it would need to be built almost full size, approx. 7 feet long, 4 feet 3 inch track. If built to your suggested scale of one third it would be useless making it 28 inches long, 17 inches track. Mine is almost full size, maybe 12 inches short but the track is the same as the original. The Stanley was only a small car in 1904." In a later letter he commented "I will have to get my Stanley out of the trailer and take some measurements for you. I don't do drawings. When I'm making a model it's all in my head. That way nobody knows if you are doing it right or wrong (as if they would know)". Well I thought, this bloke will do me. He knows what he is talking about and doesn't mince words.

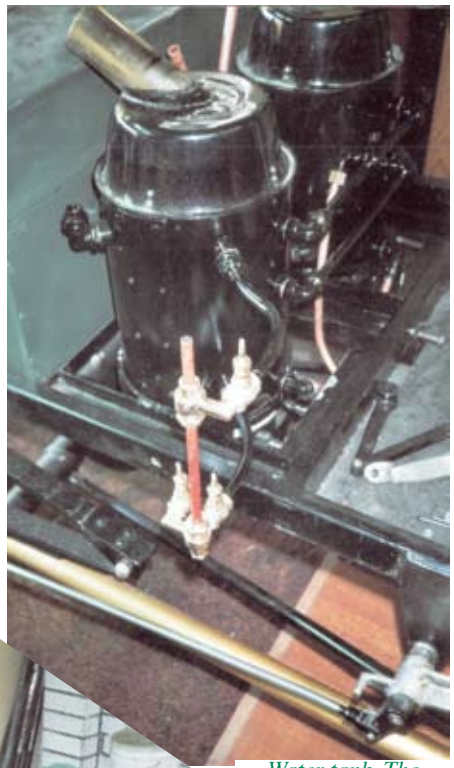
The first step in building the car was the differential as the dimensions of the diff. housing determine the spacing of the four horizontal bolts to which all the components including the main drive shaft, crosshead guide bars, valve gear (Stephenson's link) and base plate for the two cylinders are supported. The diff. internals are from a modern car with the crown wheel replaced with a straight cut bull gear. The smaller straight gear of the engine meshes directly with the diff. gear, i.e. the car has no clutch or gear box as none are required with a fully reversible steam engine. The mesh of the gears is adjusted by running nuts on these four longitudinal support bolts. Kevin couldn't remember what he had used for the diff. internals but he thought it was from a small Mitsubishi. I visited a number of car wrecking yards without really knowing what the heck I was looking for and no doubt caused a number of wreckers to question my sanity when I told them it was for a 1904 Stanley Steamer! Kevin reckoned that any small car

Engine under-hung bolted direct to diff. Note front hanger off cylinder base plate

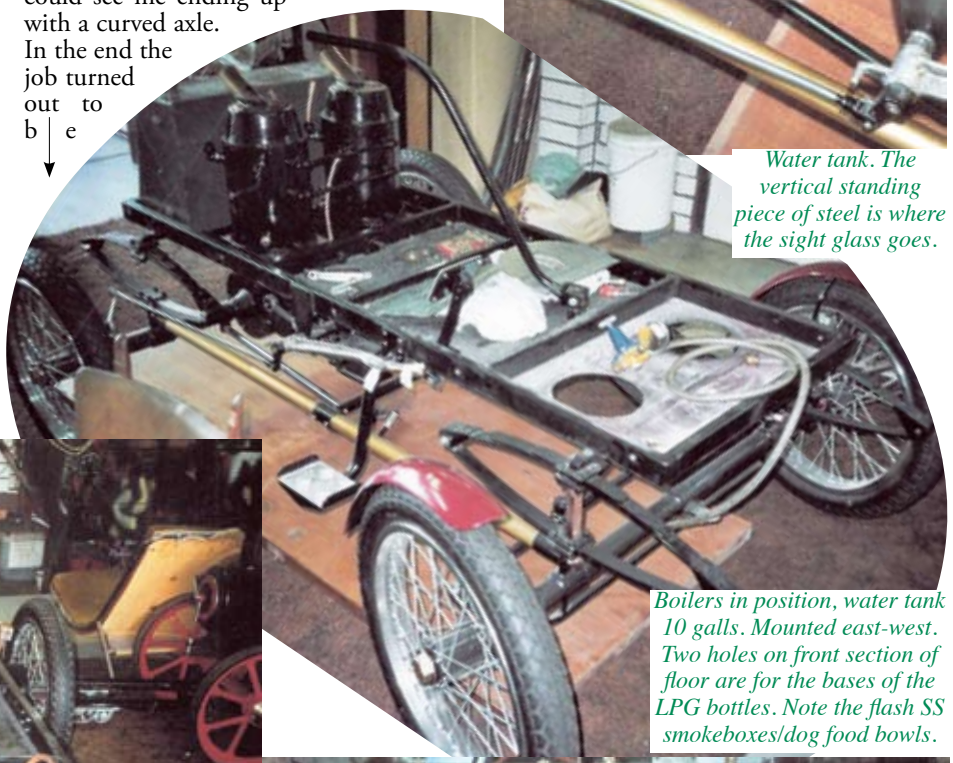
diff. would do but every diff. I looked at looked pretty big to me. I finally settled on a diff. from a Datsun Sunny. The axles that came with the diff. were too short to give me the required track. I cut the axles and welded longer axles to the original splined sections. To get alignment I used a spigot to hold the bits together during welding. Accuracy is not really critical here since for a road speed of 10 mph the axles only do about 140 rpm. However, it is nice not to have wheel wobble. The outside carcass of the diff. is fabricated from pipe welded and bolted together with brackets provided for the leaf spring attachment. I purchased from Kevin the previous mentioned bull gears being too lazy to machine them myself. The ratio of approx. 2 : 1 proved to be too low for Kevin's car and as it's turned out the ratio is too low for mine as well, even though I've increased my bore sizes to 2 inches (Kevin's bores are about 1.75 inches). Mine doesn't like gradients or soft ground. Sometime in the future I'll replace the gears with a chain and sprocket drive – it won't be traditional but using Kevin's philosophy who would know?

My lathe only has a four inch chuck so I was lucky to gain temporary employment with a mate who owns and runs a large workshop and he was agreeable to my use of his larger lathes (after work hours) to machine the larger components for my car such as the drums for the rear axle mechanical brakes. For the guts of the brakes I've used shoes, operating cams, etc. from a Honda 750 cc. motor cycle. The brakes are operated through linkages by a foot pedal and the handbrake lever which over-ride the pedal. They work like a charm in spite of Kevin's comments, viz. "I have fitted hydraulic brakes to my Stanley, this being the only way to go — mechanical brakes are B/S". He must have had some drama with his original mechanical brakes.

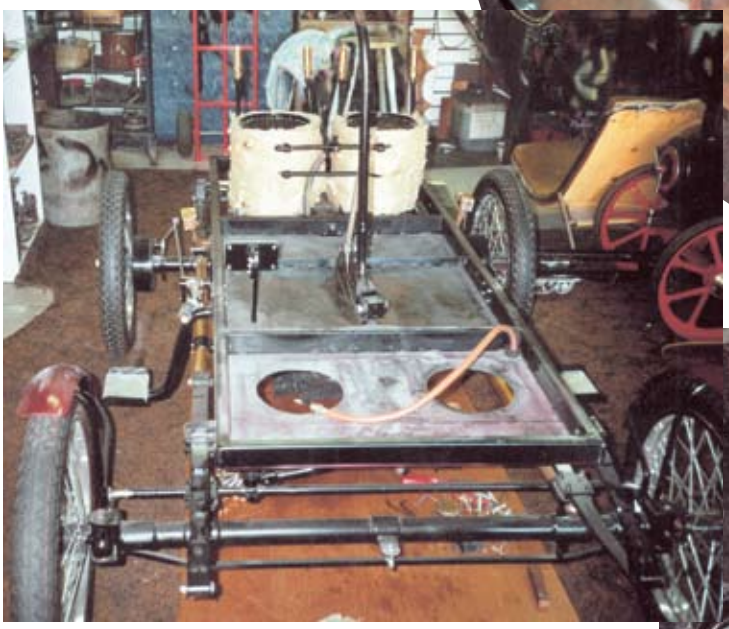
The front axle should have been a pretty straight forward exercise. It was made up of 2 inch water pipe with king pin brackets and the spring hangers together with an under-slung reinforcement bar all welded in place. Kevin was on holiday up Cape York (Qld) way when I built the front axle so I took what the Yanks call a SWAG (a Scientific Wild Ass Guess) as to camber and castor. I got it all wrong inclining the king pins the opposite way to convention and have lived with the front end of the car looking a bit like a drunk sailor for the past 12 months. What appeared to be a major rebuild exercise to correct only took about 3 hours to do. I removed the axle, cut off the welded bits with an angle grinder, turned the axle upside down and welded the lot back together and repainted the lot. Eureka! It looks like a bought one. One of the axle stub shafts was still about 3 degrees out. I thought about heating it up with the gas axe and levering it to what I desired but could see me ending up with a curved axle. In the end the job turned out to be easy. I just cut into the axle at its base with the trusty old angle grinder, wacked a weld on it and bugger me if it pulled to



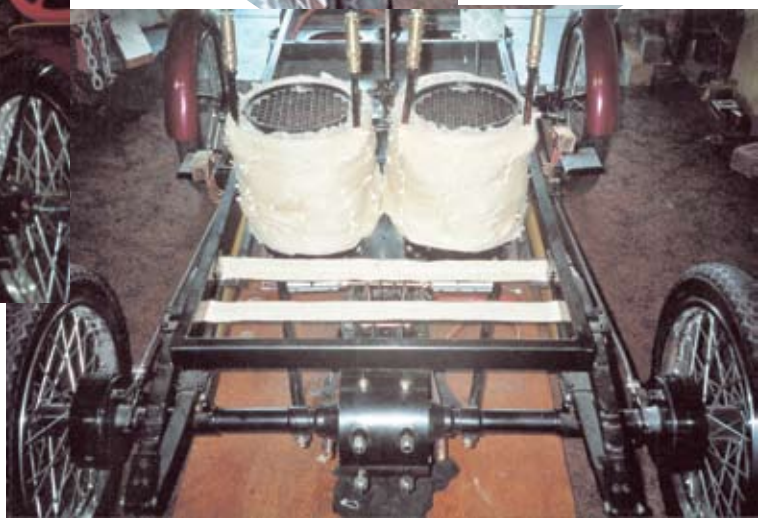
Water tank. The vertical standing piece of steel is where the sight glass goes.



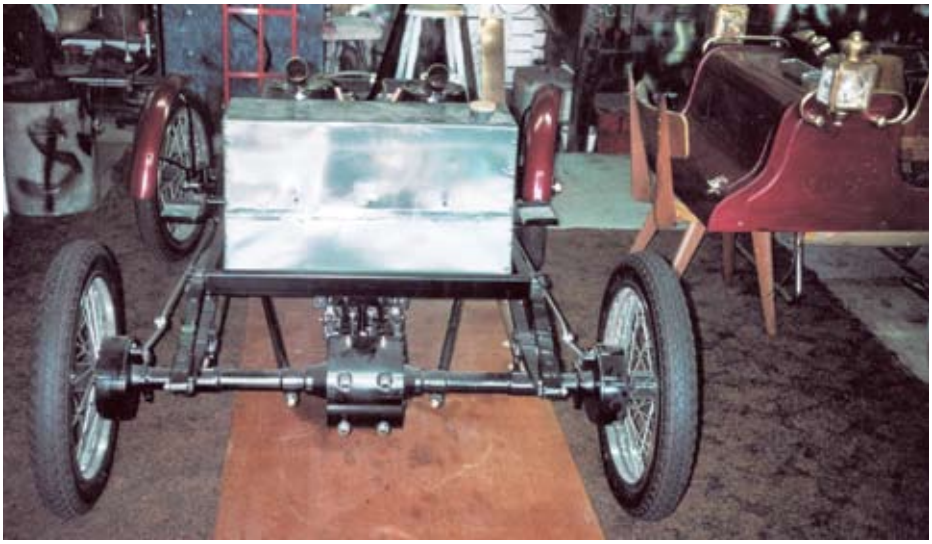
Boilers in position, water tank 10 galls. Mounted east-west. Two holes on front section of floor are for the bases of the LPG bottles. Note the flash SS smokeboxes/dog food bowls.



Single pedal is foot brake — steering very, very direct tiller type



Rear view: note water tank padded supports, boiler bagging and brake drums turned to match interior workings, from a defunct 750 CC motor bike. The extension pipes standing vertically from the boilers are for the safety valves.



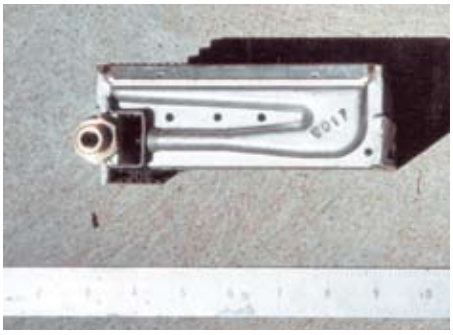
Another rear view

the exact position — Hey! Hey! Too easy. Moral of the story – what appears to be difficult at first sight turns out to be easy once a start is made. When Kevin finally returned from his holiday he told me he hadn't bothered with castor or camber and that his Stanley steered without problems.

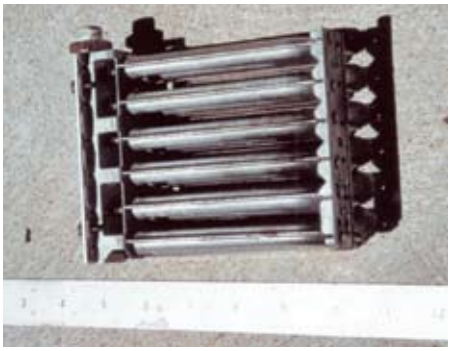
Kevin used the rims from Honda postie bikes and BMX spokes for his wheels and turned up the hubs. I couldn't locate these rims in this neck of the woods for a reasonable price – Ned Kelly now lives in WA. I settled for 750 cc Honda rims which are slightly bigger and talk about the luck of the Devil, I located a bloke in Perth who makes his living by making spokes — name the material – steel, stainless, whatever, he will make them for a very reasonable price. Turned up the hubs from mild steel stock 3 inches dia., drilled all the spoke holes (without a dividing head — I don't have one) fitted new tubes and tyres and am very happy with the result.

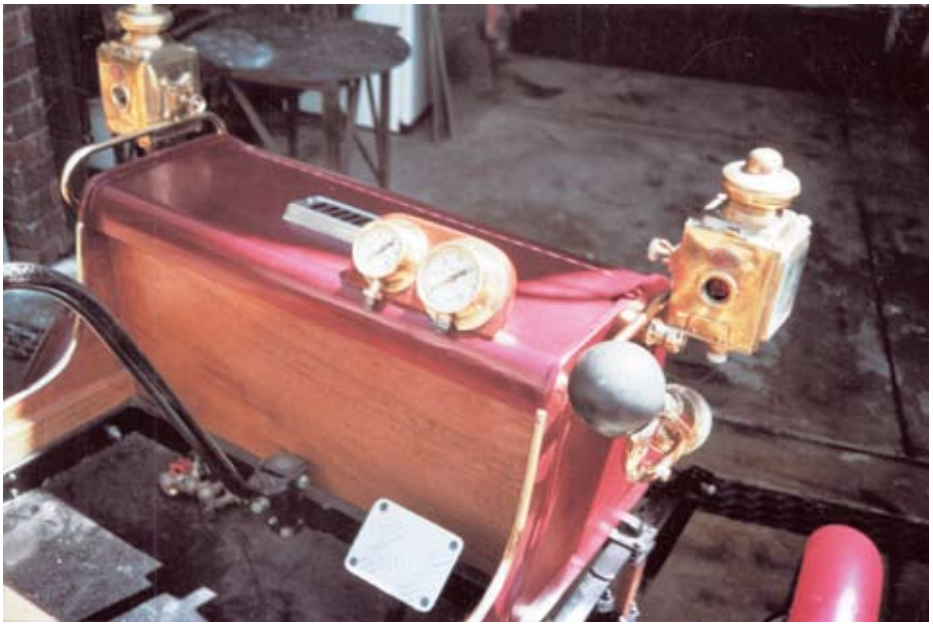
The rush was now on in earnest to mount the wheels, but first the chassis. The chassis consists of a rectangular shape fabricated from 2 x 1 inch box steel with a sheet of ⅛ inch plate welded to the bottom of this to form the floor for the cabin and the twin LPG fuel bottles mounted in the forward compartment. Next of course the springs. They are leaf type, elliptical fore and aft configuration, mounted at each corner of the car and are hand made from 1.25 x 0.1875 inch spring steel. At first I was a bit daunted by this task especially when the 'experts' rushed to advise me that spring steel must be preheated, tempered and all the rest of the voodoo rites (known only to themselves) performed to get

Marine ply body — note amateur attempt at upholstery.



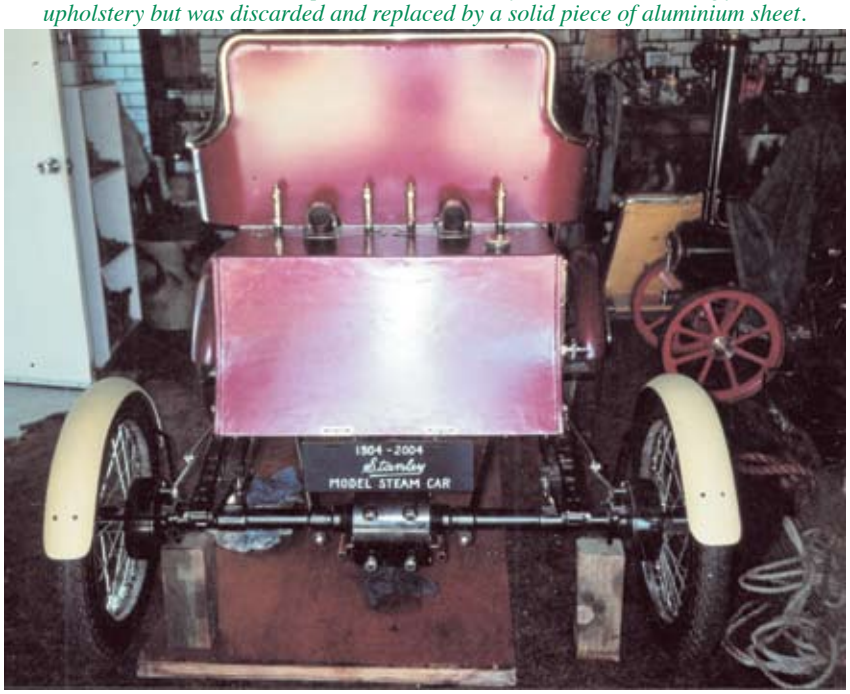
Above & below: Gas burners. A burner from a LPG hot water system cut in two (only one half, i.e. for one boiler shown). These burners run so quietly they make a whisper sound loud, and they throw out about 36000 BTUs each





Lights from a London Hansome Cab, bulb operated squawker (horn), gauges for steam and gas, brake pedal and tiller steering

The regulator and valve gear knobs. These drive the vertical shafts by bevel gears mounted under the seat. The expanded mesh was to form internal backing for the seat upholstery but was discarded and replaced by a solid piece of aluminium sheet.



My poor old seldom used Wallis & Steevens stands neglected in the background. I like twin exhaust stacks!

First time out of the shed

satisfactory results. I took Kevin's advice and bent them cold using the old tried and trusted method of belting the living hell out of them using a ball pein hammer on the inside curve with the outside ends of the leaf supported. This process is carried out until the required curve is obtained by checking against a template. Heat is required however to curl the ends of the main springs to take the bolts. I also ran the heat back along the ends of the main springs, i.e. slight temper in an effort to prevent snapping at some future date dictated by our old friend Murphy and his law. The car now started to take shape and the work rate stepped up a pace. Sitting on the skeleton of my Stanley and bouncing up and down on it like a circus monkey ostensibly to test my new springs I remembered reading somewhere Rudyard Kipling's (who evidently owned one of the originals) comments "as flimsy as a wicker basket mounted on stilts".

Steering on the early Stanleys was by means of a hand held tiller and I must admit that even as I built the car to Kevin's instructions, I hadn't stopped to think about it's operation, assuming in my ignorance that it would be similar to the number of boats that I'd come into contact with. This is not the case. If the cars tiller is pushed to the right then the vehicle proceeds that way or conversely, tiller to left it heads left. The same takes place when in reverse. This can be a bit confusing on one's first drive and bearing in mind that the steering is very direct can cause one's sphincter to pucker somewhat when steaming happily along at speed and some small emergency arises! In 1904 a similar car to mine and Kevin's, but fitted with a bullet shaped body and a 10 HP engine, was the first road vehicle to break the mile a minute barrier driven by Stanley Company test driver, a Mr. Fred Marriot. Later in the same week he wound it up to 190mph before crashing it. He survived. All I can say is that the men of that era must have been made of sterner stuff!

The construction of the engine is a straight forward exercise. It is similar to a marine engine laid horizontally. The original engines were fitted with valve inspection ports in the form of a large screwed plugs. The cylinder heads also were large bungs screwed into the top of the cylinders. This method was obviously adopted for ease of service using the simplest of tools. I was also amazed to discover that the crosshead ran in linear bearings. All the main bearings were of the ball race type and all the working parts were enclosed to prevent the entry of dust. I took a few short cuts with my engine and paid the ultimate price. My cylinder heads are held on as per loco practice with bolts as are the valve covers and that is where the problems arise. The cylinders are mounted pretty close together with the outside admission "D" valves stuck between them, so close in fact that to remove the valve cover to set the valves I now have to remove one cylinder completely, so as to get enough room to remove the remaining cylinder's valve cover to set the valve position. This whole process then has to be repeated for the other cylinder's valve setting. Very tedious considering that there is a gasket at the base of each cylinder which no doubt compresses at different rates for every time it is re-torqued. That was only part of my problems. One night I sketched up the valves to a scale of half size — and you guessed it — next day becoming intoxicated with the exuberance of my own velocity, I built the bloody things half size including the port sizes! This meant that the

cylinder ports ended up being about 20% of the size recommended by people like Greenly. Bugger! In spite of this the little car still goes like the clackers. I got the missus to follow me down our street to get some idea of what speed I could do in Stanley. She sat on 60 kliks and I pulled away from her like the old Commodore had stalled! I then ran out of street at a right angled bend. You don't want to know the toughts going through my mind! That was the end of the speed trials.

My engine has 2 inch bores each with a 3.5 inch stroke. All bearings are of the pre-greased and sealed type and the loco type crossheads are fabricated in steel and fitted with brass wear pads. The crosshead guide bars are made from 1 inch square cast iron and attached to the four longitudinal engine bolts by suitable brackets. Exhaust is direct to the atmosphere. By 1924 Stanley steamers utilised condensers and had a range of at least 100 miles.

Now the fun begins. Decision time on how to generate steam and enough of it. Flash steam out. Thought seriously about water tube boilers, in particular the Bolsover type but scrubbed this idea very quickly. The AMBSC gets a bit carried away in their requirements for water tube boilers — especially water tube thickness and the use of shell re-enforcement. I don't know where in Australia tubes of this wall thickness can be obtained. The AMBSC Code Part 1 Copper clearly states a max. pressure of 100psi., a max. boiler diameter of 8 inches and a max. water capacity of 25 litres (sorry about the metric) but it doesn't stop one from using any number of these boilers in parallel. I use two boilers each with max. dia. of 8 inches — flue tube length of 10 inches — with about 108 x 0.5 inch dia. tubes per boiler, giving about 12 square feet per boiler of heating area. Total water capacity of both boilers is 6 litres which is almost a flash steamer! This small quantity of water enables a fast initial firing up time as well as guaranteeing quick recovery after a heavy draw off of steam. At 100 psi I expect to get about 5HP from the engine with a total heat input of around 72 thousand BTU's. The two boilers are connected together by substantial headers, thermal flow tubes and a large bottom feeder manifold. Each boiler is fitted with two safety valves sized as per Code and are of the vertical type. The one sight glass is mounted remote to the boilers just to the rear of the seat on the vertical part of the car body. The rear view mirror mounted towards the front of the car is not to check on following traffic but to view the sight glass. I built a rather heavy duty (6 litres/minute) double acting hand operated feed water pump which enables me to beat the heating input and thus lower the boiler pressure. I haven't had to use it for this reason yet but it's nice to have an added safety feature. The operating handle for this pump (which is about 17 inches long) ends up between the driver and his passenger. The seating arrangement can only be described as intimate and sometimes one gets some strange looks from his passenger when the pump is operated.

Second source feed water is obtained from a 5 inch scale Westinghouse steam driven air pump which has been converted to pump water. It was such a pretty looking little pump so I mounted it externally on the drivers side of the car rather than putting it under the seat where it would have remained hidden from view. The two exhaust stacks angle out from the top of the car body just behind the seat and certainly don't look Stanley, more like some modern

Who said smug? I'm as happy as a pig in pooh! This photo, taken after I had fixed up the problems experienced on Stanley's maiden run. Speed trials followed.

Even though Gay looks ready to jump it was our first run together. I think she liked the positioning of the hand operated feed pump.

Photo taken by mate Clive Chapman's brother of Kevin driving his Stanley at Timber Town in 2003

A photo of his Stanley at Inverell, sent to me by Kevin.

Stanley makes an appearance at Bunbury in October 2005 Photo: John Shugg

day V8 petrol engine exhaust! Hopefully, it's different enough from the original to make the purists puke. Stanley boilers of this era contained a very large number of small flue tubes, ran at about 400 psi., with the boiler barrel reinforced with piano wire tightly wrapped around it. They kept a record of every boiler they built or later repaired. The Stanley cars were fitted with an ingenious little device to control the feed water flow from the engine driven (crosshead) feed pump. It consisted of a tube mounted vertically on the boiler side connected at top and bottom to the boiler. Inside this tube was a temperature sensitive rod which in turn operated the feed water bypass valve. Pretty smart engineering. When the boiler water level dropped the water in this tube covered less of the thermal sensor which then became hotter (flue temp.) and closed the bypass valve allowing feed water into the boiler.

I tried to make my LPG gas system fool proof. Because of the cyclic operation of the thermal demand the main burners turn on and off controlled by the boiler pressure. To accomplish this I modified a refrigerator temperature control unit. I removed the bulb at the end of the capillary and connected the capillary directly to the steam manifold. Steam pressure is then applied directly to the little copper diaphragm inside the control unit which operates a small micro-switch. I'm not worried too much if this diaphragm bursts as the capillary sized steam feed pipe is so small that any steam passed would be negligible. The micro switch in turn controls an approved LPG 12 volt solenoid in the main gas line to the burners. As you would be aware it is essential that both burners must be fitted with a pilot light so that when the main gas is supplied to the main burners it is immediately ignited to prevent gas pooling. Being an electrician by trade I initially tried a high voltage system and spark plugs to accomplish this. It worked after a fashion but had a major failing in that any detection that the gas was successfully ignited was missing from the system. This can happen if either one or both of the electrical systems fail. Don't forget all this is happening out of sight under the car. Scrubbed that idea. In the end I fitted each boiler with a Marty Burner gas pilot light (refer AME May-June 2005, issue 120). I removed the original Marty burner "petal" head and replaced it with a straight tube to produce a pencil like flame. Each of these pilot lights heats up it's own dedicated heat sensor (thermo-couple). A thermally generated electrical signal is then sent (independently) from each thermal couple to it's own electrically operated gas solenoid valve. These valves are mounted in series configuration in the main gas supply line. Initial firing is accomplished by manually holding "on" both of these solenoids and hand lighting the pilots. The solenoids now remain on until loss of flame or the system is deliberately shut down by turning of the main gas cocks. The main burners are left turned off until the pilots settle down. With this system if either of the pilots go out the whole gas system shuts down.

I came across a discarded instantaneous gas hot water system and used its burners for my car. I cut the burner in half and used one half for each boiler. Each of these burners throws out approximately 36000 BTU's and run quietly at a very low gas pressure of about 2 psi. I adjusted the jet sizes of the Marty pilots to also run at this pressure. Two small LPG bottles are housed in the car's front compartment and feed the gas through approved flexible hoses to a manifold and then to a gas regulator (set at 2 psi) and thence by fixed copper plumbing to the solenoids mentioned above. Each LPG gas bottle comes with its own shut off cock. Extension rods, fitted with their own handles, are attached to these cocks and pass into the car's cabin area enabling the system to be remotely controlled from the driver's position. I repeat that these burners do their thing very silently so I went to the trouble of providing peep holes in the side of the flame enclosure so that the flame can be observed if required. Readers and potential builders should be aware that LPG installations, depending on

Another photo by John Shugg of Stanley in Bunbury

Photo supplied by Kevin of his Stanley under construction

where they reside in Australia may have to be approved by a "Gas Regulator". That's a flash new name for what us peasants used to call an "Inspector". I would also advise readers/builders to check whether the draft Codes proposed by the Aust. Gas Assoc. (AGA) have been legislated, i.e. become enforceable by Law in their State. As far as the bureaucrats in W.A. are concerned my car is classed as a Type B, I class, gas appliance. To me it's a model Stanley Steamer!

The body was made from marine ply glued and screwed together and needs no further description. Kevin went to the trouble of making up brown paper templates of his Stanley's body shape and posting them to me.

Mudguards caused me to falter. How does one perform those compound curves? In my old club one of my mates has a son who indulges in medieval sword play and he makes his own body armour out of stainless steel and the finished product doesn't have a blemish on it! Really complicated shapes such as full face helmets. He has an English Wheel! What the hell is that I hear you query. It's like a very big "G" clamp with the clamp ends fitted with shaped wheels. The material is clamped pretty firmly between these wheels by the "G" clamp action. The material is then moved backwards and forwards by hand and the pressure of these wheels apparently stretches one side of the material. This gives a curved shape. That was too complicated for this old fogey so I prevailed upon him to make them for me and he produced a wonderful job making the four mudguards from ⅛ inch aluminium plate. They were so well finished they didn't even need sanding prior to painting. Thanks again Simon and Tony Jones for a job well done. He also set the curves for the seat from the same material.

Have you ever done any upholstery work? I haven't, but it's pretty easy when some one who knows how shows you. One of the members from my old club who I had helped out to finish his steam boat boiler, owned and ran an upholstering business earlier in his working life, and he put me up to the tricks. The seat lining material is cut to the rough shape and gathered up in loops at equally spaced intervals and then these loops are sewn in permanently. On my seat they run vertically. Bicycle spokes (or a length of strong steel wire) are then poked into these seams. These spokes then have pieces of strong twine attached to them at equal spaces in such a way that they pass out of the material loops through little holes cut at the back of the material. All these pieces of twine ends are then passed through the seat padding (in my case expanded foam) and then through holes in a false aluminium backing piece where the twine is pulled tight and tied off. This gives the undulating shape (or pincushion affect if so desired) to the seat material. The whole assembly is then bolted or screwed into position in front of the real back. The outside bits of the material are then pulled tight around the boundary, held in position with contact cement and covered with a shaped piece of brass strip screwed to hold it in place. Pretty simple really. The things one learns in the model making field! My thanks to Allan Mathie.

To finish off here is another shot of Kevin with his Stanley at Timber Town Photo: David Proctor

Some of you may wonder about the lights affixed to my Stanley. Despite my refusal to accept these lights which Allan offered as payment for the work I'd done getting his boiler finished and passed (I believe in helping out a fellow club member and charges for one's time shouldn't apply). I finally succumbed to his smooth, persuasive and dulcet tones. These lights are a matching pair and originally came from a London Hansome cab and are probably worth more than the finished Stanley.

Painting is definitely not my forte so to make things easier I thought that pressure pack can painting was the way to go. I wanted my Stanley to look the period so selected Burgundy as the car's colour. Would you believe that the only way I could get this colour in pressure pack cans was from a motor spare parts dealer and they only came in touch up sized cans. Each can cost about $9. I used about twenty cans to finish the job. It would have been cheaper to get the job done by a professional painter. Oh well, a mug and his money are soon parted.

The completed car was paraded up my front driveway for its maiden run up the street. It didn't perform to my complete satisfaction although the neighbours thought it was fabulous and a group of us celebrated by attempting to find the bottom of a full carton of VB and then some. The car seemed to lack grunt which really got me pondering — Was the steam delivery pipe big enough? Were the small valve apertures having a disastrous effect? Was the gear ratio not enough?

Rather than rebuild these in attempt to isolate the problem I built a little card indicator machine from information gleaned from a set of Audels Engineers and Mechanics Guide lent to me by my learned mate Clive Chapman. This valuable little tester records pressure against piston movement.

I feel I've rambled on enough in this missive (sign of old age) so details of the card indicator will have to wait for another article in the future. (Watch for the next issue ... Ed.) In the mean time, vale Kevin Hyde.