A TREATISE ON THE MECHANICS OF THE NEW PERRYMOBILE

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BOOK ONE

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PART ONE

The Inventor

Before I go into the details of this new power plant I would like to tell you something about the man who has visualized and built this car with what he calls a "Liquid and Air" motor.

Mr. Perry is a man who has grown up with the automobile, having built his first car in 1903 when he was fifteen years old. Since then he has been employed by several of the large auto manufacturers as an engineer in one and another capacity but especially in experimental and development work.

I have talked with him for many hours and have heard other men and engineers question him on the principles he uses and how they compare or relate to what we call 'conventional or generally accepted rules in engineering or physics'. In these regards I will sy that he is thorough, exceptionally well versed in all automotive design, a clear thinker, and very energetic and alert on all engineering subjects. He is honest, will give your viewpoint due respect, and appreciates any suggestions for improvement. While he is well grounded in engineering, he still devotes a great deal of time to experimenting, inventing, simplifying and combining the things that we already have in order to produce a more desirable result.

Recently Mr. Perry developed a new and very effective means of removing carbon from airplane engines at the Aircraft Maintenance Shops in Sacramento, California. This was an outstanding accomplishment and contribution to the war effort.

That brings us to the next part that I want to make clear. Please do not feel disappointed when I make the statement that there is really nothing basically new about this power plant. All its functions and principles have been used before and some of them for many years. Its merit lies in the combination of these functions, their relation to each other, and many new and ingenious mechanical achievements found throughout his power plant.

To a student of thermo-dynamics, the explanation would be simple and clear, but as I expect many people to read this

who would fail to understand it as well if I attempted to be too technical, I wish to go through each part in just as clear and understandable a way as I can.

Mr. Perry has had his Perrymobile in operation on the streets of Los Angeles and the highways of California for the past two years and though the public did not know of it until a few months ago, he has been working on its development for over seven years. While this car can still be said to be in its infancy and much engineering on it will be done in the future, Mr. Perry has already developed and proven sufficiently that he has just what you and I have been looking for in an automobile for many years. To mention a few of its advantages, it has no transmission, no spark plugs, no ignition system, no carburetor, no starter, no clutch. It has no motor noise at any speed. No gears to shift. You can stop on any hill regardless of how steep it is and start again by simply opening the throttle. You never need to hold this car from rolling backwards by applying the brakes. It has very little exhaust fumes, and, best of all, you have *full horse power* at all times. You can ease along in traffic, in or out of the driveway or garage at one mile per hour if you wish, and all you have to operate is the throttle and that is finger-tip control at the steering wheel, and you cannot 'kill' the engine.

Sounds like the old steam car, doesn't it? Well, that is very close to being just what it is, but don't throw up your hands and say that we went through all of that back in 1910, because, as I said before, this power plant though it acts very much the same as the steam engine does, it has many variations which make it worth while, most of the troubles of the steam car are eliminated and many advantages are found instead, principally because of Mr. Perry's ingenious mechanical ability.

All that Mr. Perry has designed and built is a power plant. This may be installed in any automobile of the light or middle weight class that we have today. You simply take out the gasoline motor and replace it with the Perry power unit. It operates on semi-refined fuels and weighs about one-

third as much as an 80 horse power internal combustion gasoline engine.

PART TWO

The Heater

I am going to start now into the mechanics of this car and I know that this is what interests you most.

In order to avoid confusion of terms, let me make a few explanations here.

When I use the word 'heater' hereafter, think of it as a low pressure steam boiler. Mr. Perrry prefers calling this boiler, or pressure generator, a 'heater' to distinguish it from the conventional high pressure boilers.

When I speak of 'fuel,' that is the heat producing substance such as diesel oil which burns in the burner under the heater.

The words 'special fluid,' or just 'fluid,' or 'liquid,' is the liquid used in the tubes of the heater that boils and turns to vapor to be used in the motor the same as water is used in a steam boiler.

I am not privileged to name the chemicals that are used to make up this special fluid but Mr. Perry gives the formula to you when you purchase your set of blueprints. They are very commonly known chemicals, however, and very easily obtained. One is purchased at any paint store and the other at a photographer supply house.

You may buy any amount that you desire, mix it yourself, bottle it, use it as you need it and it is non-combustable.

The heater is rectangular in shape. It is housed in a well-insulated shell and has three points of suspension in order to relieve it of any strain from twists or expansion and contraction. It is built up in sections so that it can be taken apart if need be. As many sections can be used as desired. It is therefore a variable horse power, mobile type of heater. A standard size unit is recommended by Mr. Perry

which will develop ample horsepower for the size of his motor and the weight of the car that it should be used in.

The design is identical to our most efficient water tube type of steam boiler. This unit has been used for the past several years and is a well-proven and reliable pressure generator. Here, however, he eliminates most of boiler troubles by using a 'special fluid' in it that boils at 170 degrees, which is 42 degrees less than water and several advantages are gained. First, it allows the heater to get up pressure very quickly from a cold start. There being only one quart of this liquid left in the heater when it is cold. Next, this liquid forms no scale, has no sediment and a very little bit of it is lost through the air vent. The fluid is condensed in a conventional automobile radiator after it has been used in the motor. Hereafter, I will call this automobile radiator "the condenser" because that is what it is used for.

The condensed 'fluid' returns to a supply tank from which it is pumped back into the heater and thereby used over and over. This is one of the big advantages over the steam car, which used several hundred pounds of water in a day's trip. That meant a great deal of scale, mud and oil in the boiler to contend with. The inventor claims that the average driver under average conditions will lose about one gallon of this fluid through the exhaust air vent in about 1500 miles of driving. It costs about $1.00 a gallon to make and the storage or supply tank holds three gallons. That should mean no more trouble to take care of than filling your battery with water once a month.

PART THREE

The Motor

Next I will describe the engine that he uses this vaporized liquid in. It is a V-type, four cylinder engine (two cylinders on each bank), which resembles very much our conventional internal combustion engine of today. It has pistons, connecting rods, valves, push rods, cam shaft, crank shaft

and oiling system just like a V-8 engine, except cut in half. That is, using only the four rear cylinders. It is of the L head type and the intake and exhaust are poppet valves in the head. He fabricates his whole motor, however, using separate cylinders and individual cylinder heads, special cam shaft, timing gears, etc. The motor is only nine inches long and eleven inches high. The bore is 3 3-16 inches and the stroke is 4¼ inches.

This makes a very small and light weight motor, especially in relation to pounds per horse power. He has the motor mounted in a model A Ford chasis just like our motors are mounted today, and hooked up to the drive shaft direct with a universal joint as the only coupling. This sets the motor about where the clutch and fly wheel are on our cars of today and leaves the rest of the space under the hood for the heater.

The cylinders are staggered enough to allow two rods to be used on one throw of the crank shaft. The crank shaft is a standard one cut in half near the center and having the two main bearing ends machined to fit special ball bearings and timing gear. The timing gears and case are on the front end of the engine. The two main bearings are ball bearings.

Because there is no vibration to this motor, it is bolted solid to the car frame by four motor hangers.

There are no water jackets used on these cylinders or any coolant of any kind. The temperature of this motor wants to be kept as high as possible.

One and one-half pints of cylinder oil is used in the crank case and this lasts several thousand miles because there is no vacuum or suction to pull the oil off the piston or cylinder walls into the upper part of the cylinder.

There is no compression in this motor at any time. It operates by pressure only.

The crankcase is ventilated by means of a breather.

PART FOUR

The Action of the Motor

To explain the action of the motor, it operates on the

principle of the single action steam engine, or, like a simple compressed air motor. It is two cycle in operation, the pressure being on the top side of the pistons only and each time a piston is forced down it is a power stroke. This makes this four cylinder motor equivalent to an eight cylinder, four cycle gasoline engine as far as the power strokes are concerned.

The pressure in the heater is maintained between 145 and 150 pounds per square inch and when the throttle valve is opened the pressure in the intake manifold rises to 150 pounds. As this motor can never stop in any position without some intake valve being open, the pressure rises in that cylinder to 150 pounds per square inch also. Consequently, any time the throttle valve is opened, the car starts moving in proportion to the volume of vapor admitted through the throttle valve. There is no cut off of the vapor in the cylinder like there is of steam in a high pressure steam engine. In this motor, the intake valve opens at 5 degrees past piston dead center and remains open until the piston is within five degrees of the end of its stroke. The mean pressure on the power stroke is 150 pounds for the entire stroke when the motor is under full load. When the motor is under partial load, or only a fraction of its total horse-power is being used, the throttle would be only partly open and the vapor that would be admitted through it would be small in volume and the pressure actually used on each piston would diminish to only a few pounds. This is true of all steam or pressure type motors and makes its vapor economy run very high. In other words, it uses just whatever power it needs in the form of vapor from the heater to do what you command of it, and when the car is standing it does not use any. The result is an almost perfect and unfluctuating flow of power at any speed which gives no vibration and super smooth performance. This is not true of gasoline or diesel engines.

To reverse the car, a small lever on the steering column is moved, which actuates a compressed air valve that operates a small compressed air booster which moves the cam shaft lengthwise one-half inch. There are two cams for each valve lifter. One cam being just opposite to the other. When

the cam shaft is in one position the valves open and close so that the motor revolves, let us say, clock-wise, and when the cam shaft is shifted to the other position, all of the valves are in just the opposite relation to what they were and the motor must revolve counter-clock-wise. It runs as well backward as forward.

The camshaft could be shifted by manual controlled linkage and the booster eliminated if you desired to build it that way.

PART FIVE

Other Motor Features

It is, of course, necessary to have a six volt electric generator and a six volt storage battery for lights, horn, etc. The generator revolves at a ratio of 3 to 1 and is mounted under the right bank of the motor and driven by a V belt from the front end of the crank shaft. There is an oil pump attached to the back end of the generator which pumps oil from the pan into the dipper troughs for the connecting rod bearings. This pump and piping could easily be eliminated by attaching a dipper to the crank shaft which will fill the troughs and give the same results. The pistons, cam shaft, etc., are oiled by splash.

Under the left bank of the motor a small air compressor is mounted which pumps air into a storage tank. On the back end of the air compressor a fluid pump is attached which pumps this special fluid from the supply tank into the heater. There is a one-way valve in this line so that no fluid can come back out of the heater when the car is standing and the fluid pump is not working. Remember that this motor never 'idles.' It is directly connected to the drive wheels of the car and the only time that the fluid pump, air compressor, oil pump or electrical generator revolve is when the car is in motion.

There is one other thing about the motor and that is that it has an exhaust port in the lower side of each cylinder wall

which is uncovered by the piston at the bottom of its stroke. In other words, each cylinder has two exhaust openings but they are connected together by a common exhaust manifold and the used vapor is carried to the top of the condenser. This side exhaust port allows any condensation in the motor to get away freely and you can start off with a cold motor without any hesitancy or trouble.

This is very important and one of the many outstanding features of this motor. Steam engines have always been built horizontal or vertical. When they are cold, they must be blown off and warmed with steam to eliminate any condensation before being put to work. But with this Perry motor, it makes no difference how cold it is or how much moisture there is in the cylinders or manifolds, if a piston is on its downward stroke, the cylinder will be cleared of its moisture through the side port and if the piston is on its upward stroke, the condensation will be forced out through the poppet exhaust valve.

Each exhaust opening is large and no moisture can be locked in the cylinder and cause a knock when starting the car.

The wet vapor is forced into the condenser and never seen or heard about the car.

Under operating conditions, the side exhaust port allows the pressure to drop in the cylinder to nearly atmospheric pressure, then the poppet exhaust valve opens in the head when the piston is on its upward movement and relieves any resistance or compression of the vapor that is left in the cylinder and acts merely as a scavenger valve.

The skirt on each piston must be long enough to keep this side port covered when the piston is at top dead center; otherwise the crankcase would be open to the exhaust manifold.

PART SIX

The Fuel System and Burner

There are several types of fuel available for heating the heater and two general types of burners.

The simplest and least expensive burner is the vaporizing type. This type, however, requires a No. 1 grade of fuel with high volatility and ignition characteristics such as gasoline or Butane. It is the least expensive from a construction and installation standpoint, but the high cost of the fuel makes the operating expense run very high. The draft may be natural but a blower or fan is necessary if the exhaust line for the burnt gas is long and small.

Mr. Perry has this type of burner on his demonstrator and is using Butane as the fuel. This is alright for experimental purposes, but he does not recommend it for regular use, however, because it is too expensive, too hard to obtain, the tank must be taken off the car to be filled, a special tank is required, and it has a definite fire hazard.

The safest and most advantageous type is the atomizing burner. It is more complex and expensive to construct and install but will pay for itself in a short time because it burns the No. 2 and 3 low grade fuel oils. These fuel oils such as diesel or stove oil, cost but a few cents a gallon, contain more heat units per given volumn than the higher refined types, are non-combustable, have good ignition characteristics when atomized and the fire hazard is almost entirely eliminated.

Mr. Perry is working on the development of a special burner of this type and for the heater he describes and recommends in his blue prints. It will be available some time in the near future.

It will be ignited by a spark plug using a vibrator type of coil on the 6 volt battery used in the car. A high pressure fuel pump and forced draft will be operated by a 6 volt D. C. motor.

This is without doubt the most intricate unit on the car and the best of engineering services and oil burner knowledge and experiences should be used, otherwise it may operate uneconomically and be a constant source of trouble.

The tank that is now used for gasoline in our present cars makes an ideal fuel tank for the Perry Power plant and no changes would be required if diesel or stove oil is used.

PART SEVEN

Back to the Heater

Now that we have a general idea of the plan of the car and the units which go to make it up, let us go farther into the operation of the heater.

This heater is what is called, 'pressure controlled.' That is, under operating conditions the liquid in it is vaporized by the heat from the burner and the pressure begins to rise. When the pressure comes up to the 150 pound mark, an automatic pressure valve shuts off the flow of fuel to the burner. Then, if the throttle is opened, the pressure drops in the heater, the automatic pressure valve opens again at 145 lbs., the burner lights automatically, and the pressure begins to rise.

When the car is being used on the road, the liquid from the supply tank is pumped into the heater tubes and becomes preheated. From a thermo-efficiency standpoint, this heater pre-heats the liquid and super heats the vapor about as efficiently as can be done today in a mobile type of boiler.

Each type of boiler has its advantages and disadvantages both from a viewpoint of construction and operation. The water-tube type that Mr. Perry recommends and details in his blueprints, combines most of the good qualities of these various types and is a great improvement over anything we have ever had before and makes an ideal heater for this Perry motor.

Good insulation on the heater, intake manifolds and upper cylinder motor parts, helps to decrease the loss of heat, through radiation, in its transfer from the heater until it is used in the motor.

Because the controls on this heater are entirely automatic, there is nothing for the operator of the car to do or remember excepting to turn the switch on and off as you would your ignition.

The amount of ilquid in the heater or supply tank must be looked at occasionally, however, and for this Mr. Perry recommends using a glass type water gauge on the heater.

By coloring the liquid green, the height of the liquid can be more readily seen. The gauge has a very small inlet and outlet hole to avoid any large amount of vapor escaping in a short time in case the glass should be broken.

These glasses withstand extreme pressures and where only 150 pounds pressure is used, the chance that one would break from that cause is very remote.

PART EIGHT

The Steam Cycle

Without going further into detail about the heater, let us follow the steam cycle around and have that much clear in our minds before we go on.

We will say that the fire has been turned on and that the pressure is up in the heater. The throttle is opened and the steam vapor enters the intake manifolds. The inlet valve that is open admits the steam to that cylinder and the pressure rises against that piston until it begins to move down. When the piston reaches the bottom of its stroke, the intake valve closes, the steam escapes through the side exhaust port, out through the exhaust manifold, into the condenser and the condensed vapor then runs back to the supply tank by gravity. From there the liquid pump draws it out and forces it back into the heater to begin its cycle over again. This is relatively simple and differs very little from that of a low pressure steam engine. The condenser also acts as a muffler for the exhaust which eliminates any noise and leaves no tell-tale vapor behind the car.

PART NINE

The Compressed Air Cycle

There are two forms of energy used to make this motor operate. One is the steam cycle that I have just explained

and the other is the compressed air cycle that I am going to explain now.

This has been the hardest part for all of us to comprehend so read it carefully and I will do my best to make it clear.

The use of this air system is the secret that adds to the efficiency and convenience that makes this car surpass anything that we have yet in the form of power for automotive use. Compressed air has been used for power for many years. So has steam. But as far as I know, they have never been used together and worked out to advantage under the conditions that Mr. Perry has perfected them.

Let us follow the compressed air cycle through now. The compressor is a 2¼ by 2¼, two cylinder, standard unit with a double V velt drive from the front end of the crank shaft. When the car is in motion the compressor will build up a storage tank of air to 160 pounds. This is ten to fifteen pounds higher pressure than the heater operates at. There is an air line that runs directly from the air storage tank to the top of the heater. This line has a one way valve in it so that no vapor can return under pressure from the heater to the air storage tank, should the pressure be lower there than it is in the heater. Then as the cold air enters the heater it becomes heated right along with the vapor in the top of the heater and the heat thereby increases the volume of the air somewhat. In other words, some of the heat from the burner is absorbed by the air and it goes out into the intake manifold with the vapor from the special fluid, does its work in the motor, loses its heat, contracts, goes through the condenser and out through the same line that the liquid does and empties into the liquid storage tank. There is a separator in this tank that allows the fluid to go to the bottom and the air escapes through a vent in the top of the tank, then through a pipe to the rear of the car. This is what is called the air vent or air exhaust pipe. There is a small amount of the fluid lost out of this air vent as I mentioned in Part Two. Incidentally, there is another pipe that carries the burned gas from the top of the heater to the rear of the car, so there are two exhaust pipes.

In the first place, compressed air is a very inefficient form of energy to create and then use as power. Then to have an air compresser connected to the crank shaft so that when you drive along the motor compresses air to fill a tank to be used again in the motor sounds like trying to raise yourself by your boot straps. Well, right here is a very critical part and I want you to understand this thoroughly. Very few people who attend the demonstration go away understanding this air cycle and it is one of the most important functions and cleverest recovery of power that has been given to us by anyone in the automotive field.

While this air compressor is a positive drive from the crank shaft on Mr. Perry's demonstrator, that is not the way he intends that it should be. The air compressor should only operate or do its work when the car is coasting. The potential power a 3000 pound car has, when traveling at 30 miles per hour, is enormous. In our cars of the present type, each time that we bring it to a stop this energy must be wasted or dissipated in the form of heat in the wheel brakes or running the motor against compression.

This wasted energy is to some extent recovered in the Perrymobile by the momentum of the car operating this air compressor and building up a reserve tank of air, a portion of which will be used again the first time that the throttle is opened. The size of the air compressor, its gear ratio, the size of the air storage tank, the amount of coasting or stopping and the type of driver that you are, all enter into the amount of energy that will be recovered and it affects the over-all efficiency of your driving. If you make quick, short stops you will not get the benefit or efficiency that you will by taking advantage of the time element there and filling the air storage tank. To explain this another way, let us say you start out on a long, straight uphill grade. The throttle is partly open all the way. In a case like this, there is no efficiency at all from your air system. All of your power is generated in the heater and your motor operates as a steam engine only. If the air compressor is not automatically con-

~~would be an additional drag on the motor. Another instance~~

trolled so that it cuts out when the throttle is open, then it would be an additional drag on the motor. Another instance

of this would be that if you put this motor and heater in a boat, you would leave the air system off completely because a boat will not coast.

Now let us take a case of driving in the other extreme. You are coming from the mountains and doing constant down grade driving. The air compressor operates all of the time you are coasting and fills the air storage tank. When it gets to 160 pounds pressure, a pop-off valve opens and any extra air that is pumped into the tank escapes through this valve. No energy is being used in your motor and because the pressure is up in the air storage tank and the heater, there is no fire on. Then, suppose you come to a small hill that you must climb, or, a short level stretch. There is maximum air pressure built up from coasting and as the hill is approached, the throttle must be opened in order to maintain your speed and develop the power necessary in your motor to carry the car over this hill or short level stretch.

The length and grade of the hill, the size of your air storage tank, the weight of your car and other factors will determine whether or not you can go over it on stored or 'free' power. If the hill is surmounted without the pressure dropping to a point where the fire comes on, you have gained in overall driving efficiency.

Now let us say that we come to a hill or a long level stretch after coasting, that is too long or steep for us to get over on stored air and that we must use some power from the heater. When the throttle is first opened, the stored air or 'free' power is used and the pressure starts dropping from the 160 pound mark in the air storage tank. When the pressure goes down to 145 pounds, the automatic pressure control on the burner turns on the fire. Because no energy has been used from the heater, even though the fire has been off, the temperature of the liquid in the heater is at or near the boiling point. Due to the type of heater and its large area of heating surface, the pressure will rise faster than it can be used, according to Mr. Perry.

Now that we see that this power plant will operate in both extreme types of highway driving, city driving can easily be understood and is explained at some length in Part

Eleven. In a city or town where constant traffic stops are encountered I am going to estimate that ten to fifteen percent of the power that an average driver would use can come from the compressed air system. If this is true, the overall economy of this car as far as fuel consumption is concerned and considering the price per gallon, greatly exceeds our present cars.

Only constant engineering, trial and time, will find the balance there for the size of the compressor, the gear ratio, and automatic valve action, etc., that will give us maximum driving perfection.

PART TEN

Two More Things About the Heater

The first one is, that as you drive along the fluid pump pumps the special fluid into the heater from the three gallon liquid supply tank faster than it can possibly be used under any conditions. That means that the liquid supply tank is kept empty all the time that your car is being driven. That also means that the heater has a maximum of three gallons of fluid in it while the car is in use. When the car is driven into the garage at night, the electric switch turned off that controls the burner and the pressure turned off from the compressed air tank, the liquid in the heater gradually drops in temperature, the vapor that is in the heater condenses back to liquid again and the pressure in the heater continues to decrease. When it gets down to 5 pounds, a spring loaded valve opens in an outlet pipe which has a small opening in it near the bottom of the heater. The liquid then runs by gravity back to the supply tank through this outlet pipe. The outlet is just high enough in the heater to allow one quart of fluid to remain in it. When the heater switch is turned on the next time, this one quart of fluid vaporizes readily, the pressure begins to rise, as it passes the five pound mark the outlet valve closes and the heater tubes fill with vapor. As no fluid can or will enter the heater

until the car is put in motion, as I explained in Part Five, this one quart of fluid simply stays vaporized and the entire heater acts as a super-heater. This method to a great degree approaches the ability of the flash type boiler which is very advantageous when making a cold start. Mr. Perry says that this heater will get up full 150 pounds pressure in 1½ minutes.

As the car gets under way, the fluid is pumped into the heater slowly enough so that the pressure will not drop and the heater tubes gradually become about one half filled when the supply tank is emptied. The top portion of the heater being a vapor chamber. The heater then acts as a water tube storage type boiler and has the advantages of holding its heat and pressure for a long time, depending upon how well it is insulated, atmospheric temperatures, etc.

Right here I would like to advance some new ideas in hopes that we can forget or overcome, or even compare this day with that of the old steamer times twenty to thirty years ago.

Today we build a boiler by electric welding processes—not riveting or swedging. No stay bolts are used, nor wire wrapping, and we have a stronger, more efficient, super-safe, trouble-free, boiler than existed even a few years back by many, many times.

Automatic controls, burners, valves, connections, gauges and testing have been perfected in the past twenty years to a point where we do not question their ability or use at all. Take our hot water heaters in our homes for instance, or furnaces. Once they are installed and lighted we walk past them year in and year out and rarely ever service them.

The units in Mr. Perry's car that we would build today would be made with a large factor of safety and because of its simplicity and modern design, I firmly believe that the cases of trouble that we would have would be minor and far between. In the case of a smash-up on the highway there is not nearly the danger from fire when using Diesel oil as compared to the gasoline we use in our present cars. Consequently, the fire insurance rate on this car will be lower than on gasoline cars.

As for the safety of the boiler, that is taken into consideration from every phase from the time it is designed and built until its period of usefulness is over and it should last several years.

Then I would like to say a word about economy. Before they put thermostat controls on water heaters and even after they did, we only used to turn them on when we wanted hot water for a bath. Then it became customary to have it on for dishes and sometimes it was forgotten and left on all night. Nowadays, we have come to the place where we will not consider turning it off at all. We like the convenience and are willing to pay a little extra for it. However, the insulation used in them today so greater reduces the radiation of heat that nothing would be saved by turning it off except if you were sure of not using it for a long period of time.

So will it be, and rightly, with the Perrymobile. Just leave the heater switch on and your car will be ready to use any time you want it.

The other part about the heater that I have not explained before is that the compressed air from the air storage tank enters the vapor chamber in the heater and does not go through the liquid at any time. The vapor collects in a drum in the upper part of the heater and the only escape for this vapor or air is through an outlet pipe connected to the top of this drum. As only vapor and air can ever be in the drum and it is placed where it receives intense heat from the burner, it acts as a super-heater and raises the temperature of the vapor and air in it from 170 degrees to 240 degrees. The vapor and air then carries as much as 70 degrees of 'super-heat' when the fire is on.

The super-heated vapor and air then leaves the heater and goes to the pressure side of the throttle valve.

PART ELEVEN

How to Operate This Car

Let us say that the car has not been used for some time

and that the heater is cold. The first thing to do is to switch on the burner and let the one quart of liquid in the heater start absorbing heat. Then you open the valve from the compressed air tank and that puts cold air pressure in the heater. All you have to do then is put it in reverse, back out of the garage, close the doors, back out of the driveway, and when you have reached the street the boiler has the pressure built up provided that you do not do this in less than 1½ minutes. There can be many variations of this but the point is that you have the storage tank of air that will allow you to move your car some distance while the heater is generating pressure. The man who leaves his car in the street, would have to start slowly or wait for the pressure to build up, especially if he had to start up-grade. The larger the air storage tank, the more convenient and efficient this source of power is in any case or event. I am sure that you can now readily see in what instances or conditions the part that a 'live' heater would be necessary or beneficial without any further explanation.

The Perrymobile must be equipped with foot brakes and a parking brake as cars are today, but they have nothing to do with the power plant. The only instruments you need in the driver's compartment is a pressure gauge, a speedometer and an ammeter. There are other indicators that can be installed and used, but not strictly necessary. Probably the next most important instrument would be a thermo-electric gauge to tell the height or amount of liquid in the heater. There must be one switch for the heater, and one for the headlights; an anti-theft lock, a reverse lever, and a throttle lever.

On very steep down grades you can put it in reverse and by opening the throttle a little, the speed or momentum of the car can be checked or controlled without the use of the brakes at all. This should only be done by someone who understands what they are doing, however. The car is relatively simple to handle and the pleasure of gearless noiseless driving can only be appreciated when you have experienced it.

I have used the word 'throttle' here but to many people

it is known as the accelerator. It is the same thing and may be hand or foot operated, or both.

The liquid in the supply tank or heater should be kept at or near the three gallon mark. However, it may get down to as low as one gallon and the car function all right except in very warm weather. Because this liquid boils at such a low temperature, it may not condense readily enough on the desert and under desert conditions and more condenser area may have to be installed. In other words, two automobile radiators would have to be used because it is almost mechanically impossible to put a fan on this car. Besides, fans are noisy and consume a large enough percentage of power from your motor that if they can be avoided it is worth while.

If enough condenser surface cannot be obtained, water can be used as the fluid in the heater under extreme heat or desert conditions and water will condense faster at air temperatures of 100 to 125 degrees Fahrenheit. Even if you were to run out of this special fluid on the highway, you would just fill the fluid supply tank with water and the car would operate fairly well. The future is going to prove many things about this car that we do not know now.

When the car is stopped, you may or may not turn off the heater, but you set the hand brake, shut off the valve from the compressed air tank, and lock the car against theft as you would any other car.

PART TWELVE

Who May Build This Motor

First, I would like to say that I am in no way connected with Mr. Perry or his organization. I am simply trying to put before anyone who is interested, the facts about this car as I see them and this entire booklet is my own opinion of it. Frankly, I have watched it for some time and have complete confidence in its ability and performance from a practical

standpoint provided the person who builds and uses it will follow Mr. Perry's recommendations. As I said before, the Perrymobile is in its infancy and improvements will be made in the future. As for the most part, what I have said here is just what you would hear and see if you went to the demonstration and paid your one dollar admission fee.

Anyone may build this power plant today provided that he buys a set of blue prints from Mr. Perry. When you purchase the blue prints, it gives you the license to build one Perry Power Plant from them and one only. He also will give you any and all necessary instructions and help in an advisory and engineering way until you have the motor built and in use. He is very thorough and will assist you in any way he can, either through the mail or at his office and Show Room in Los Angeles.

I do not know what he intends to do with his power plant or patents in the future. For the present he is doing the best he can to have manufactured and made available for those who have purchased his blue prints, the motor and heater parts that require special machining, casting, pattern work, or jig or fixture drilling and thereby assist licensees to build and complete their units quicker and with less expense. The cam shaft is of special steel and the most exacting part to machine.

If you have the ability, the desire, the facilities, the time, the material and all the other necessary links to the chain that it takes to complete a project like this, then you can start at any time.

On this date, September 1, 1945, I understand that there are about five hundred individual power plants being built in or near Los Angeles. There are engineering companies here in town starting to make the more difficult parts in production now. Mr. Perry is having the heater, burner, and cam shaft built under his supervision. In the future, they intend to put out a catalogue of all the parts that are available or recommended and their respective prices. No doubt, later on whole motors may be purchased, assembled or disassembled.

PART THIRTEEN

Where and How to Use This Power Plant

This power plant is not designed to be used in an automobile like we have today that weighs over 3000 pounds. In order to make this clearer, let us take a specific example.

Say you have a six or eight cylinder sedan that weighs just 3000 pounds. When you take the motor out along with the transmission, clutch, fly wheel, starter, carburetor, manifolds, exhaust pipe, muffler, and other incidentals, you will have taken out about 1000 pounds. That leaves the remains weighing 2000 pounds. The Perry Power Plant complete weighs approximately 300 pounds. Therefore, the finished weight should not be over 2300 pounds with the liquid and fuel in it ready to go.

Of course, the same number of passengers or weight can be transported or carried that you would have before and this same car now with the Perry Power Plant in it will out-perform anything on the road today. The pick-up, getaway, or acceleration is much faster than the cars we drive now. If the throttle is opened on this car too fast, the drive wheels will spin or something is apt to break.

Mr. Perry recommends a 2½ to 1 gear ratio in the differential. I understand that he has a gear box designed now and will be produced soon that will fit on the rear of the Perry Motor so that constant mesh stock gears of different ratios may be used in it and thereby eliminate the trouble of changing gears in the differential. Most of the light and middle weight cars that were built around 1940, have differential ratios ranging from 4 to 1 to 4.5 to 1. By using a 2.5 to 1, that means that the Perry motor will revolve only 55 to 60 percent as fast as any given car speed. This results in a great deal less internal friction, wear, vibration and motor troubles in general than our present cars which have such high motor speeds at high car speeds even with overdrives.

For the present, at least, I can see no place for this power plant in heavy trucks, due to the condenser trouble that would be encountered. The Diesel motor has proven

itself in that field. However, none of the principle factors that we want in pleasure cars are found in Diesel engines today, but are so decidedly true in this Perry Motor. As it is designed today, the Perry Power Plant can be used very advantageously in small boats, and the problems of condensing the exhaust are easily overcome. Because of its low weight per horse power, so few moving parts, simplicity, quietness, ruggedness, and ability to operate for long periods of time without attention, it should find many places to be used and applications such as stationary work, farm machinery and etc. provided that enough condenser room and area can be installed. I sincerely believe that it is the future motor for our pleasure cars for several reasons, many of which I have pointed out already. The one other main reason is that this power plant can very easily be used on the rear axle because it is so light and small. Rear motor drives will allow motor car designers to give us better vision, styling, comfort, room and safety.

PART FOURTEEN

My Position

No doubt after reading this booklet there will be many questions that will come to your mind that you would like to have me answer. I would appreciate the privilege of doing so, but because of the shortage of help and typewriters I do not have facilities for letter writing as yet and have to depend on public stenographers.

Some questions I may not be qualified to answer because there are at least five different and individual engineering subjects encountered in this set up besides the machining, bench work and other trades and there are very few men who are qualified to answer authoritatively on all of them.

However, if you feel that I have left something out that I should have mentioned or made more clear or definite, I will be pleased to have you call it to my attention and if necessary I will write and answer it for you. I intend to

rewrite this booklet every four months in order to overcome this situation and make it as complete and self-explanitory as possible and also to keep it up to date with any changes made in the car.

If you have any questions that are of paramount importance to you and that you desire to have me give special attention to, I will do my best to help you. By that I mean, that I will get an answer direct from Mr. Perry or some qualified engineer or book, but that will be extra expense I expect you to pay for in advance. In most cases I do not see why it should exceed $1.

My engineering training was in electricity.

PART FIFTEEN

What it Costs to Build

This is probably the question most often asked and the hardest one to answer. There are so many different situations encountered by so many different people and under differing conditions. For instance one party may live on a farm hundreds of miles from an industrial city. Another man may have to hire someone else to do all or part of the work and that runs the cost especially high. Some man may own a machine shop or garage and even have numerous parts that he can use at little or no expense to him. I heard one man say that his had only cost him $100 outside of his time and after selling his old motor.

There is one rule to follow, however, and that is: any part that you can buy already machined or made under production methods, buy it and use it.

Mr. Perry says that $400 will buy all of the parts finished, but that you have to take them when and where they are available. Then you assemble the parts, remove the gasoline engine and install the Perry Power Units.

It is a power plant that can last a life time, so make it right, and it will pay for itself in use and satisfaction even if the initial cost does run high.

PART SIXTEEN

Miscellaneous Points

1. In the State of California there is no special license required for a car quipped with a Perry Power Plant. The regular gasoline license is used.

2. In the State of California no special operator's license is required. The same that you use for driving your present car is all that is needed.

3. In the State of California when a Perry Power Plant is installed you must file a motor cost estimate with the Motor Vehicle Department in order to determine the value of your car for tax purposes. Also a number will have to be stamped on your motor.

4. This is no stock selling scheme or anything of that nature at all. The only money Mr. Perry receives is from the sale of blue prints and the admission fee for the demonstration. He sincerely wants this creation of his to be owned, used, handled, familiarized and enjoyed by as many people as possible the world over and does not intend that some company buy it and shelve it. This is not the first thing that he has invented.

5. Because of the fast dwindling petroleum deposits in the United tates especially, you can readily see what a great relief and benefit the economy of this would mean to our nation.

6. This special fluid used in the heater will not freeze until the temperature gets down to 30 degrees below zero.

7. Any altitude from sea level to our highest passes of 12,000 feet does not affect the power or efficiency of this motor in any way.

8. The normal operating temperature of this motor is around 200 degrees Fahrenheit.

9. The exhaust from this motor can be carried through heaters inside the car for passenger comfort, then back to the condenser.

10. Because a car will weigh about 700 pounds less with this power unit in it, the question often arises whether or not the ride or balance of the car will be materially affected.

So far there has been nothing objectionable mentioned by any of the several owners here in Los Angeles. Front springs and shock absorbers can be adjusted somewhat and in most cars the difference in ride will not be noticed. The front end of any car will set up a little higher however unless front springs of lower weight are installed. There would actually only be about 500 pounds difference on the front springs, 200 pounds being transmitted to the rear springs.

11. Since the Perry Power Plant uses only 150 to 160 pounds of pressure, that is relatively safe when 1000 pounds of pressure ordinarily is used and considered safe in steam operation.

12. There has been no provision made yet for a speedometer connection. There are many places and ways to drive one from such as the timing gears, an extra sheave and V belt on the crankshaft, the drive shaft, or crank shaft flange. Once you decide which is best for your case and the connection is made, a small gear box is available that can be installed in the speedometer cable line in order to get the correct ratio. A speedometer repair or supply house can give you more accurate details on this.

13. Because there is no vacuum on this car anyplace, an electric windshield wiper will have to be used.

14. As a theft prevention lock, some other lock will have to be used than the heater switch because the car could be driven until the pressure went down too low. Probably locking the throttle in the closed position would be the most satisfactory way.

15. Now I think that you will agree with me when, as I said before, that there is really nothing radically new about this power plant, no alchemy, nothing mysterious, or fantastic. It is based on all of the principles that we have known and used for years. But Mr. Perry has ingeniously made a combination of mechanical features that gives us a pressure type motor with many new advantages and eliminates the objectionable features that were so common to the steam car.

16. The condenser can never freeze when driving in subzero weather because of the constant heat from the exhaust. When the car is standing the condenser is always dry. A

thermostat can be installed on the heater that may be set to keep the liquid at any desired temperature. In this case, more than 5 pounds pressure will have to be maintained in the heater, or the return line shut off between the bottom of the heater and the supply tank, otherwise the liquid in the heater would drain back to the supply tank as explained in Part Ten.

17. This is an idea that just occurred to me and I want to put it in here in case it might help someone who may be constructing a unit now. This is entirely unproven and may not work out as well as it seems to me that it should.

The drive shaft or torque tube will have to be lengthened from 6 to 18 inches in almost every installation in an automobile.

The transmission that Mr. Perry has designed that would fit on the back end of the motor that I mentioned in Part Thirteen is not yet available.

Getting a 2.5 to 1 set of gears for the differential of most cars is a very hard thing to do and changing them is also another arduous job.

My thought is to take a regular automobile transmission, turn it around end for end, mount it in the drive line on the end of the drive shaft or torque tube. If this does not add length enough to reach the motor, the difference can be overcome by making the stub shaft between the motor and transmission the desired length.

Lock the transmission in second gear, take the gear shift controls off and leave everything out of it that is not necessary. Here, however, there will be four gears in constant mesh where only two are needed as in Mr. Perry's transmission.

A transmission with a silent type set of gears should be used. Use one where the second or intermediate gears have a ratio of about 30 teeth to 50 teeth. Do not consider or count the number of teeth in the countershaft gears.

To make this a little clearer, let us say that your differential ratio now is 4.2 to 1. If the intermediate gears were 2 to 1, that would cut your ratio in half or 4.2 divided by 2 equals 2.1 to 1. That is too low so you must use a ratio

of about 3 to 5. 4.2 times 3 divided by 5 equals 2.5 approximately.

I do not know just what can be found for this.

18. I am intentionally going to avoid giving a horse power rating on this power plant. So many different ways of indicating horsepower have been used in this country and they have been so thoroughly abused that most of us have come to think that the average automobile must be rated at or near 100 horsepower. These ratings are taken under ideal conditions and mean very little when a car is in use on the highway. What we do want to know and accomplish is that this heater, motor and condenser will sustain a car of recommended weight at 75 or 80 miles per hour on a level highway for several hours. Also that it will climb our most severe grades at reasonable speeds, without the heater losing pressure or any part of the power plant faltering.

That is one reason why the heater is made in sections. As many may be used as are needed. That makes the horsepower variable and each owner can have just what he feels that he would use or want.

Ninety per cent of our driving is done on a small portion of the total horsepower rating. It would also be useless and uneconomical to maintain too large a heater.

This type of power has the advantage of being able to deliver an over-rated amount for a short period of time which accounts for and produces the fast acceleration at intersections.

Use the heater that Mr. Perry recommends and the burner that he is developing and this will come very close to doing what the average person requires.

With this new burner, I think that Mr. Perry's figure of 30 brake horsepower is very conservative.

Sometime in the future when we can get three different cars on three different brake horsepower machines, we will get a reasonable accurate rating.

19. Because this is a four cylinder engine and each downward stroke is a power stroke, that means that when one piston is half way down, another is just starting down on it's power stroke. With a 3 3-16 inch bore and 150 pounds

per square inch pressure, there is 1200 pounds exerted on the crankshaft by each piston. As there are two pistons with pressure on them, that means 2400 pounds pressure on the crankshaft at full load. Using a 2½ to 1 gear ratio, there is more than twice enough power to raise this car straight up in the air.

20. There are certain types of radiators for automobiles that can be used as a condenser that will cool the exhaust much faster than ordinary automobile radiators. Because you need the best condenser possible, the 'coldest' type is most desirable and any reputable radiator company or specialist can advise you on this.

Because of the enormous amount of heat that will be dissipated by the condenser, a shield should be installed back of it in such a way as to deflect that hot air down under the car and not allow it to come back against the dash and floor boards, especially in warm weather.

The amount of heat radiated from the motor, manifolds and heater will not be excessive if they the properly lagged or insulated.

21. The figures that I am going to quote here are not thoroughly proven by actual tests yet but from past experiences in steam operation, other mechanical functions and Mr. Perry's demonstrator in particular, I want to give you some reasonable estimate of what this car should do in ordinary use.

1. We should get at least twice the mileage per gallon of fuel that we do today on our present cars. Because this fuel costs one-half as much as gasoline, the ratio then is 4 to 1. Four miles for the cost of one today in fuel alone.

2. The Perrymobile crank case holds 1½ pints of oil. It should last at least 5000 miles. Our present cars hold twelve pints of oil and should be changed every 1000 miles. That is a ratio of 8 X 5 or 40 to 1. In other words, we will buy one-fortieth of the cylinder oil that we do today for the same mileage.

3. Because no carbon forms the valves never need grinding, the pistons and rings are always free, no chance to score the cylinder walls, no blow by, very slight crank case dilution, no heating, choke or ignition troubles. This motor should operate 100,000 to 200,000 miles before it needs to be taken apart for reconditioning and then it should not cost one-tenth as much to overhaul as a 6 or 8 cylinder gasoline engine that we have today. The ratio there is about fifty to one in favor of the Perrymobile.

One of the additional expenses to operating this power plant is the special fluid, which according to Mr. Perry will cost about 80 cents per 1000 miles, more in warm weather and less in cold weather.

What expense or repairs that the heater will require in 100,000 miles of driving is problematical. There will be no scaling, mud or cleaning expense, but the tubes directly over the fire will oxidize and burn away in time, and have to be repaired. For this reason, the heater is built in sections and the ones needing replacing can easily be installed at reasonable cost. I would estimate that a heater should last seven or eight years or 80,000 to 100,000 miles of driving. By then there will be improvements in insulation, controls, burner, etc., and the cheapest and best thing to do is to replace it with a new one.

The rest of the car operates at about the same expense as our present cars. Better tire and brake mileage will be gained however, due to the reduction in weight and smoother action.

The condenser should never be any expense.

22. Because there is no compression to retard the car when decelerating, the air compressor must afford this resistance, in order that the foot brakes would not be used excessively.

23. There are several different ways of controlling the automatic valve action for the air compressor that will turn it on when slowing down or stopping and off when the throttle is opened.

Your ingenuity and creative ability would be appreciated for the most practical solution to this problem.

24. There are several reasons why Perry Power Plants will be built and used. Many of which I have mentioned before,

such as low weight per horse power, super performance, economy of operation, etc. Then there are two rather human reasons why they will be built.

1. There are men who have mechanical ability and facilities who can build this unit complete from a set of blue prints and probably make improvements in it. It can be worked on as a hobby and practical project at the same time. Imagine the keen satisfaction that this man would have. Many of us can remember very vividly our pioneering days in radio when we built our first sets in 1921 and 1922. It took a lot of our time, patience and money, but what a thrill we got listening to those first broadcasts.

2. Then there is a large group of men, of which I am one, who have grown up shifting gears, cleaning spark plugs, listening to knocks, pushing these internal combustion crates uphill with all their noise, vibration, wheeze and ping and hoping each day that some good man would discover a way to make an automobile that you could drive by simply moving a little lever, glide away at any speed, up hill and down, as quietly and silently as though you were coasting, without any effort on your part.

Well that has come to pass with the development of the Perrymobile if we can but realize it.

Several months ago, Mr. Perry made a hill climbing test with his demonstrator. Fargo Street is the steepest paved hill in Los Angeles and the city has posted a sign at the foot of it which reads, 'Caution, 32.0 Per Cent Grade.'

Because Mr. Perry has taken the body off so that everyone can see the power plant and accessories better, he made up the difference in weight by placing sand bags on the chassis.

The first part of the hill he climbed very slowly. There was no jerking, hesitancy or faltering at all.

Then he stopped by closing the throttle to a position where the pressure just held the car. After taking a good look at the view, he opened the throttle about half way and the car climbed the rest of the hill as effortless as though it was on a level road.