A Description of the Delling Steam Car

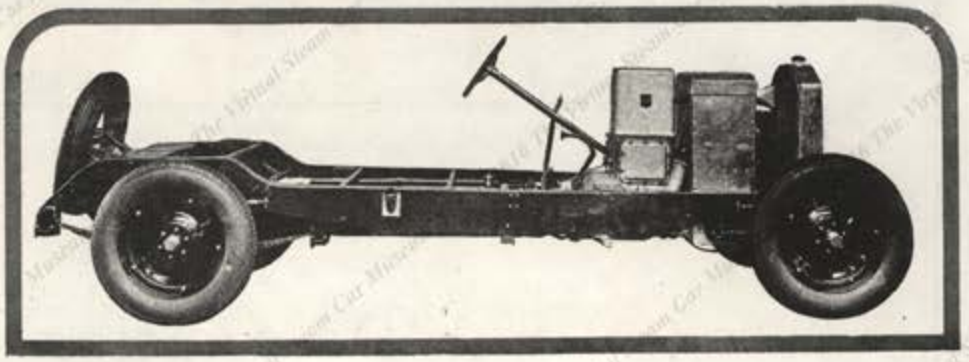
Reprinted from the July Issue of

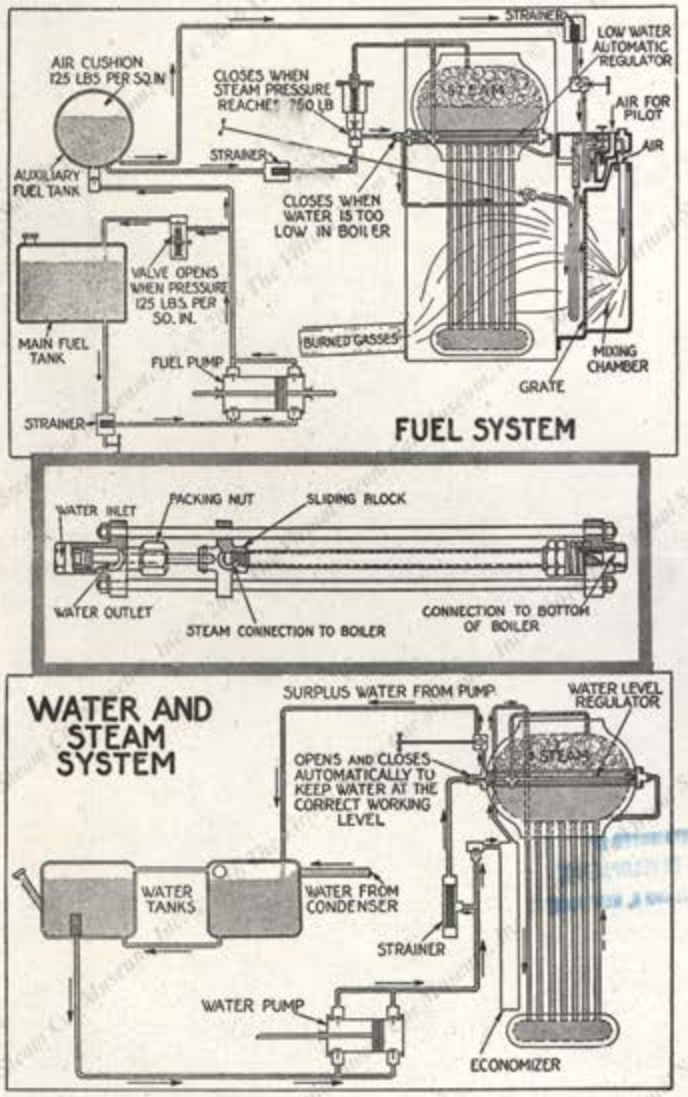
MOTOR

The Automotive Business Paper

The Chassis

Reading from front to rear, the main chassis units are: Condenser, boiler, engine, two longitudinal water tanks either side of drive shaft, transverse auxiliary fuel tank, main fuel tank





The upper diagram shows the features of the fuel system, the lower view illustrates the water system, and the middle drawing shows the principle of the automatic regulator

Some Folks STEAM Here is a New One

EVER since automobiles have been built a certain indeterminate section of the public has wanted steam cars—and still wants them. This demand is based somewhat on the idea that the "personality" of the steam car is different from that of the gasoline car.

One is a blonde, the other is a brunette, and which is fundamentally superior is not of prime importance. No doubt gasoline cars will always possess some advantages over steam cars, and likewise steam cars will always offer some features that gasoline cars cannot give.

But given a steam car that is reasonably trouble-proof,—a car that does not require any more attention than the modern gasoline car, there are and probably always will be a certain percentage of motorists tickled to death to own such an automobile.

Even after admitting that the majority of people will probably always prefer gasoline cars, the fact remains that the steam car has never had a fair chance for it is reasonably certain that if even a fraction of the many millions spent on the development of the gasoline car had been spent on steam car development there would be several successful steam cars on the market today.

When a steam car is in perfect tune it gives wonderful performance. It has enormous acceleration and prodigious hill-climbing ability. It is as quiet as an engine-less car and its control is ideal in its simplicity. No clutch, no gears—just a throttle to be opened and closed.

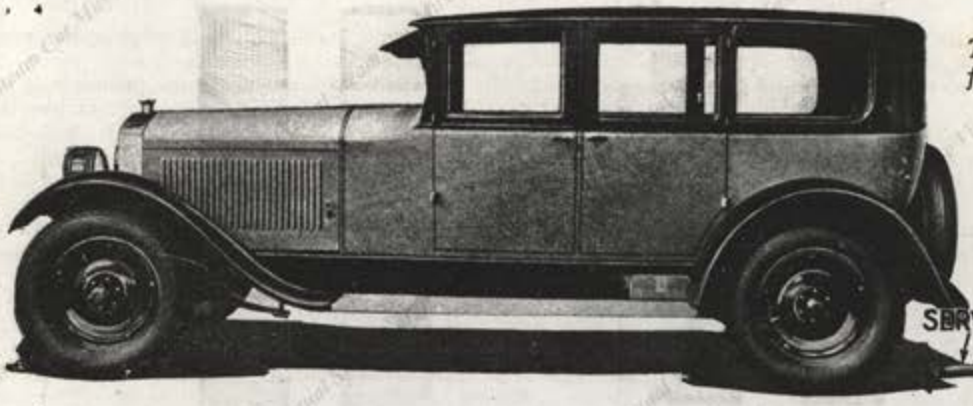
Little progress has been made in the past 20 years in steam car construction. Here and there a lone operator has attempted to bring the steam car up to date but for one reason and another none of these efforts has gone over and perhaps after all the biggest handicap that these steam car enthusiasts have had to encounter is lack of capital.

In many respects most of the steam cars now in use—and there are a few—are possibly 15 or 20 years behind the times in development. Year by year the gasoline automobile has strode steadily forward whereas the steam car has nearly stood still. Certainly very few people, even steam enthusiasts, are willing to buy a car that is so far out of date whereas quite a few people would be glad to purchase a steam car really up to date.

Reasoning along these lines, several years ago Mr. P. R. Delling began the development of a steam car which is now offered to the public by the Delling Motors Co.

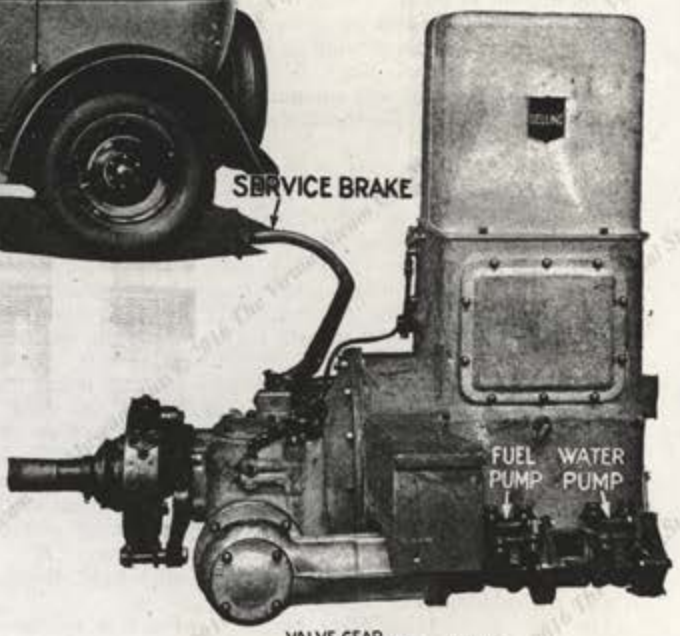
From extensive experience with steam cars for a number of years Mr. Delling concluded that a steamer with a conventional type of burner was fundamentally correct in principle, just as the four-cycle engine is regarded as fundamentally right for a gasoline car.

Experience also had shown him that there were certain

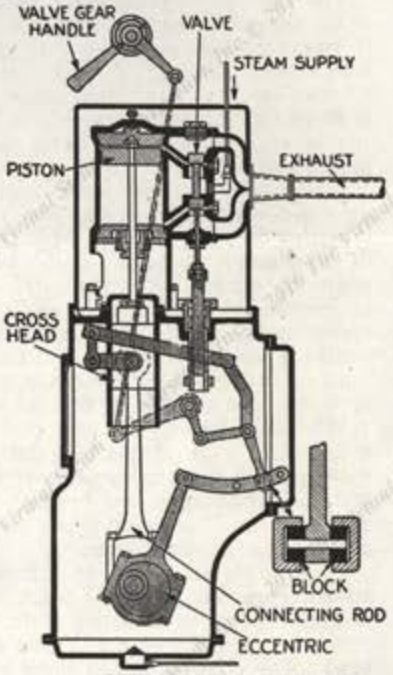


The sedan is the first job ready for the market. It looks like a gasoline car

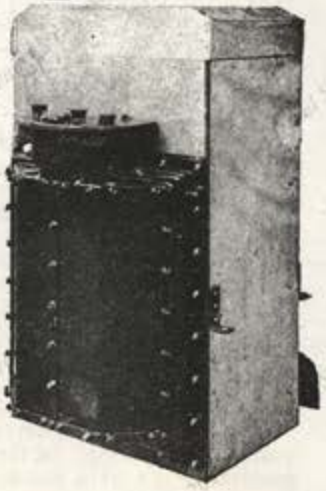
Like a CAR— *of Improved Design*



Above—The engine is a neat design. The pedal operates the hydraulic brakes. Fuel and water pumps, lower right, are driven by a connecting rod attached to a cross-shaft operated by the drive shaft



Right — Section through engine showing details including valve gear. Valve gear is reversed by shifting the position of the "block" in its grooved quadrant



Right — A simple vertical-tube boiler is used. The burner is the black area in the foreground

defects or bugs in existing steam cars just as there were also some serious defects in the gasoline cars of 20 years ago, but he believed that the elimination of these bugs was simply a matter of common-sense engineering, and with these thoughts in mind he set out to bring the steam car up to date by eliminating its defects.

There is therefore nothing spectacularly new about the Delling steamer. It contains all the elements of earlier steam cars but each element has been designed and redesigned until it would perform with that degree of perfection which the motoring public has been educated to demand.

The car is of conventional appearance; it looks no different from a gasoline car. It has Eaton axles, Lockheed hydraulic four-wheel brakes, a drive shaft with a "transmission" brake, Ross cam and lever steering gear, and a conventional frame.

The car sells for $2895 as a five-passenger phaeton and $3500 as a five-passenger sedan. It has a wheelbase of 132 inches and 20 by 6.20 balloon tires.

The powerplant consists of a boiler and engine under the hood. The boiler supplies superheated steam at 750 pounds pressure to a two-cylinder, double-acting engine with a bore and stroke of 3¾ by 4½ inches. The engine is connected to a drive shaft which has a two to one reduction in the rear axle. Steam from the engine is condensed in the condenser which looks like a radiator.

The performance of this steam car is fascinating and it is this feature which explains why a certain number of people want steam cars. Its acceleration measured with a stop watch is approximately double that of the best gasoline cars, yet acceleration is so smooth and effortless that it is difficult to appreciate the celerity with which it gathers speed.

The car is started from rest merely by opening the throttle which is conveniently located directly under the wheel. It glides away so silently it gives the impression that here is a car with no engine at all which runs miraculously on its reputation—to paraphrase an old joke.

As the car gathers speed there is heard the hiss of air rushing into the burners. It is no louder than the noise made by most carburetors although on gasoline cars this noise is so effectively drowned by more powerful noises that few are

aware of it. On the other hand, the sound of the in-rushing air on this steamer while slight is somewhat more noticeable than it would be otherwise because of the silence of the rest of the mechanism.

The engine is so quiet that it takes a good ear to hear it at all. In fact at speeds of 30 to 40 miles per hour the most noticeable sound is the singing of the tires on the road! And 40 miles an hour seems like 20, so smoothly and silently does the car run. There is of course no clutch or gears. The car is started by opening the throttle and slowed down by closing it. In ordinary driving the only other control member used is the pedal brake which acts on the four wheels.

The car is backed by reversing the engine. This is done by turning a handle on the instrument board which shifts the valve gear. This handle has two positions in the forward direction. One position gives an early valve closing, good steam economy and sufficient power to climb almost any hill—this is the usual running position. The other position gives a late valve closing, power enough for any occasion, but steam consumption is higher.

The car may be started regardless of how long it has been standing instantly on level roads, although if a hill must be climbed immediately after starting, it is necessary to wait about 15 seconds to get more steam up. These desirable features are secured by operating the pilot burner continuously night and day. While the fuel consumed by this device is small it supplies sufficient heat to keep steam up continuously and automatically. It also prevents freezing.

If the car should be laid up and the pilot light shut off it may be lighted again electrically.

The principal details of the engine construction are shown in the vertical section through one cylinder. The piston, since it works in both directions, is equipped with a piston rod which passes through a stuffing box. The piston rod drives a cross-head to which the upper end of the connecting-rod is attached. All stuffing boxes on the job have metallic packing which wears a very long time before the gland nuts must be adjusted.

Intake and exhaust ports are opened and close by the up-and-down motion of the piston valve. With the valve in the position shown steam from the boiler is being admitted to the chamber above the piston while the chamber below the piston is exhausting. The stroke of the piston valve may be lengthened or shortened while the engine is running by operating the handle on the instrument board shown diagrammatically above the engine and the engine is reversed by the same means. Varying the stroke of this valve varies the time at which steam entering the cylinder is cut off.

While the valve gear may look unnecessarily complicated it is really quite simple and durable. The same design of valve gear is used today on nearly all American locomotives and its advantages are briefly, low friction, slight wear, engine reversal with only one eccentric, and quick opening and closing of valve ports.

A more detailed explanation of this valve gear and its advantages would be out of place here and suffice it to explain that the valve is actuated from two sources: 1—By the eccentric rod and 2—By a bracket attached to the piston cross-head. The combination of these two motions gives the valve action desired. Reverse is secured by turning the handle which shifts the block to the other side of the pivot.

The boiler, an ideal design consisting of seven rows of vertical steel tubes about ¾-inch in diameter is attached above and below to a heavy cast steel header. These headers appear to be much stronger than necessary—a good fault from a safety standpoint. A boiler explosion is a practical impossibility because the very worst that could happen is to have a tube split or burn out; allowing steam to escape in exactly the same fashion as in a punctured tire.

The tubes are filled with water and the flame passes between the tubes from the burner which is located vertically along the front side of the boiler. The simplicity of the tubing makes collection of sediment inside the tubes an impossibility while sediment which collects in the lower header is blown out every month or so by opening a convenient valve—the same as is done in a large steam power plant.

In principle the burner resembles the burner on the conventional gas stove. In the latter it will be remembered that gas rushes out of a nozzle surrounded by several air holes, and that the rushing gas draws air along with it, the resulting mixture issuing through holes in the burner when it is consumed. In the Delling burner, the same principle is used both for main burner and pilot burner, except that provision must be made for vaporizing the gasoline first, this being done by passing the liquid fuel through a heating coil.

In describing the boiler and its accessories it is advisable to consider the fuel and water systems separately. The burner will use gasoline or kerosene with equal facility and will also operate on crude oil although the last is not widely enough distributed to be a suitable fuel for motorists roaming over the country.

The main fuel supply of 32 gallons is carried in a conventional tank at the rear of the car. From thence it passes through a strainer equipped with a drain valve and from thence is drawn to a double-acting piston pump. This pump is identical with the water pump and the two are mounted in tandem and placed alongside the flywheel housing, being driven by a single connecting-rod which is operated by a cross-shaft which is driven from the drive shaft by skew gearing. These pumps make 115 revolutions per mile and they are absolutely silent. They are equipped with spring-closed poppet valves as indicated.

The pump delivers the fuel to an auxiliary tank partly filled with air. When the pressure in this tank rises to 125 pounds the relief valve opens and the fuel flows back to the main tank. With this construction fuel in the auxiliary tank is always at 125 pounds while the car is running, while with the car standing still and only the pilot burner operating the pressure in this tank is sufficient to keep the pilot light burning for a long time.

Fuel flows from the auxiliary tank to the pilot burner, passing through a strainer and a shut off valve on the way. The fuel flows through a heating coil exposed to the pilot flame and is vaporized, then proceeding to the pilot jet from which it issues with sufficient velocity to draw in the air required for combustion. This mixture of air and gas flows through the holes in the burner and bursts into flame. The face of this burner is about 1 by 4 inches and has numerous small holes. The pilot jet is fitted with an adjustable needle valve.

Before detailing the fuel piping to the main burner it must be explained that the boiler is fitted with a diaphragm-type steam pressure regulator which shuts off the fuel supply to the main burner when boiler pressure rises to 750 pounds, the main burner going out, to be lit again by the pilot burner when pressure drops to 700 pounds which turns on the fuel supply again. Also located in this piping is a low-water regulator which shuts off the main burner if in case of oversight the water level reaches a certain low point. Actually the device never comes into action unless the operator allows his water supply tanks to become empty.

Assuming boiler pressure less than 750 pounds, fuel for the main burner flows from the auxiliary tank, through a strainer, through the steam pressure regulator valve, through the low-water regulator valve, through a shut-off valve, through a heating coil placed in front of the burner where the fuel is vaporized by heat. The gaseous fuel then branch to two identical nozzles, only one of which is shown. T fuel gas flowing out of this nozzle entrains some air with it and flows into the burner mixing chamber where it passes through numerous small holes and is consumed.

When the pressure rises to 750 pounds the pressure regulator valve closes, and, assuming there is 125 pounds pressure in the auxiliary tank, the fuel relief valve opens and the fuel flows back into thee main fuel tank. Note that fuel and water pumps work continuously while the car is in motion.

The fuel also flows through the relief valve if the low-water regulator valve closes. The main burner valve is normally shut off when the car is standing still and is turned on by hand just prior to driving away. The handle to this valve is located in the driver's compartment.

There are two water supply tanks, hung lengthwise at either side of the drive shaft. Two tanks are used simply because they fit the layout better than one tank of twice the size. The two tanks are connected top and bottom by pipes.

Water is added through a filler opening extending through one running board apron. The other tank has an overflow

hole as shown. The water return pipe from the condenser is also indicated.

Water is drawn by the feed water pump through the check valve to a row of economizer tubes which are about twice the diameter of the boiler tubes. The purpose of these tubes is to warm the water up before it enters the boiler. Since the flame from the burner passes through the boiler from front to rear, cooling off on the way, some of the heat remaining in the gases after they have passed by the boiler tubes is picked up by the economizer tubes. Without this construction the heat thus gained would be lost.

After passing through the economizer the water flows up through a pipe and enters the boiler at the top, the pipe continuing down through the header and connecting with one of the boiler tubes, water flowing down through this tube to the lower header. The purpose of this construction is not only to introduce the water at the coolest part of the boiler but also to guard against loss of water in case the check valve should leak with car standing. The latter effect is realized by drilling a small hole in this pipe in the upper header. Obviously if it were not for this small hole, if the check valve and pump valves should leak, the steam pressure would slowly force the water in the boiler back through the pump into the supply tanks. Once the pump has raised the water level to a certain pre-determined point, the water level regulator valve opens and the water instead of entering the boiler flows through a return pipe to the water supply tank.

Both the low-water regulator, which is a safety device to shut off fuel to the main burner, and the water level regulator just mentioned are identical in construction, both being mounted on the right side of the boiler, the latter obviously being placed higher than the former. They operate on the thermostatic principle, and are placed at a slight angle with the horizontal. A long brass rod is housed in a tube forming a jacket around the rod. One end of the jacket is connected to the steam dome of the boiler and the other end connected to the boiler water which lies below the steam. Since the steam in the jacket is normally hotter than the water, inasmuch as the latter has a better chance to cool off, the temperature within the jacket depends on the ratio of steam and water and this in turn depends on the water level. When the rod is very hot it expands and closes the valve and when relatively cool the valve opens.

Steam generated by the boiler is drawn out through two tubes in the upper header, each tube with many fine holes so that there is practically no liquid in the steam passing to the engine. The two tubes run to the throttle valve and from thence a single tube carries the steam to the superheater which consists of piping placed between the boiler and the burner where it is exposed to the hottest part of the flame. From thence the steam goes to the engine. The boiler is provided with a safety valve.

Pistons, cylinders and piston valves are lubricated by steam cylinder oil introduced by a small, automatic steam injector in the steam supply line. Main and rod bearings are pressure lubricated by a gear pump, same as on gasoline engines. When the steam is condensed the oil in the steam is carried along with the water and remains in the first water tank where it spills out of the overflow when the water tanks are filled. The exhaust, after leaving the engine flows to the radiator or condenser which is built of finned horizontal tubes. The water from the condensed steam flows back to the supply tank as previously indicated. If through very rapid acceleration or very high speed the condenser is unable to liquefy all the steam, the steam flows along with the condensed water into the supply tank where it flows to the atmosphere through the overflow hole.

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