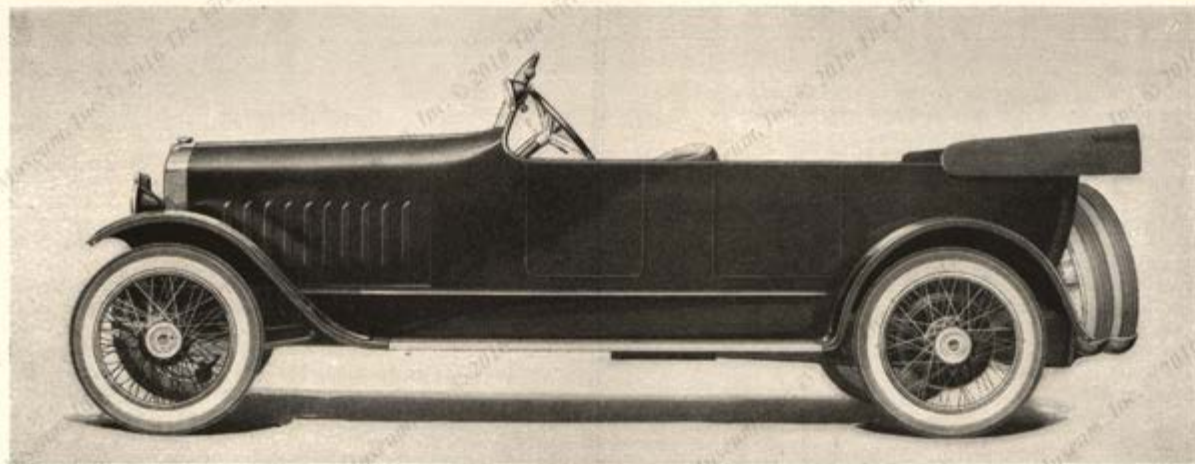


The
DOBLE
Steam Car



GENERAL ENGINEERING COMPANY
DETROIT, MICH.

T H E D O B L E S T E A M C A R



DOBLE SEVEN PASSENGER TOURING CAR

AUTOMOBILE engineers have for years recognized steam as the ultimate source of power. Abner Doble has developed a steam power plant by nine years of persistent work which makes the Doble Steam Car pre-eminent among motor cars.

Actual performance is the standard by which motor cars are judged. This is what the Doble Steam Car will do:

It will creep along at less than one mile an hour and accelerate to sixty in fifteen seconds. That is flexibility.

It climbs any hill, on which the wheels can secure traction, although the engine is geared one to one with the back axle. That is power.

There are only twenty-two moving parts in the Doble Steam Car, of which eleven are in the engine. There is no gear-set clutch, or drive shaft. That is simplicity.

The Doble Steam Car uses only kerosene for fuel, and runs fifteen miles on a gallon. One gallon of lubri-

cating oil suffices for eight thousand miles. That is economy.

All exhaust steam is condensed and used over and over again, thus insuring absolute silence and conserving heat energy. The car will run 1000 to 1200 miles on twenty-five gallons of water.

The burner is lighted by an electric spark. The car will start in one minute although perfectly cold. After standing ten hours it will start in twenty seconds. Cold weather can never cause ten or fifteen minutes of bad running, as in a gas car.

The two cylinder Doble engine gives the same number of impulses per revolution as an eight cylinder gasoline motor, with the added elasticity and power derived from steam.

To sum up—the Doble Steam Car possesses perfect flexibility and silence, more power and speed than is actually needed, extreme simplicity and economy.

It is the highest type of motor car yet developed.

DOBLE STEAM POWER PLANT

THE steam power plant, designed by Abner Doble and used in the Doble Steam Car, consists primarily of the steam and water system, the fuel and combustion system, and the engine or power transmission system.

The Doble generator in point of construction is based on the water-tube type, and carries a water level in the evaporating zone.

It consists of 28 identical sections placed in an insulated casing. Each section consists of two horizontal headers connected by sixteen vertical tubes. They are made entirely of cold drawn seamless steel tubing of about one-half inch diameter. The vertical tubes are swaged at either end to about three-eighths of an inch, and are welded to the headers by the autogenous acetylene process, thereby making the section in effect one piece of steel, and actually stronger at the welded joints than the tubing itself.

The combustion chamber is directly beneath the steam generating sections, while the exhaust for burned gases is below the economizer sections.

The intake water manifold delivers water simultaneously to the economizer sections through their lower headers, the water being forced in by a crank-driven plunger pump. When the economizer sections are completely filled, the water overflows from the upper headers into a manifold, which delivers it simultaneously to the lower headers of the evaporating sections.

Here the water level is maintained about half way up the generator by means of a by-pass valve, so arranged that when the regulator tube is filled with steam and consequently hot, the by-pass valve is closed by the expansion of this tube, forcing the water from the pumps to lift the check valve and enter the generator.

As the water level rises the regulator tube is filled with water from an exposed pipe. This water, not being in circulation in the generator, is quite cool, so that the relatively large change in temperature causes the regulator tube to contract, thereby opening the by-pass valve and allowing the water to return to the supply tank.

The hot gases rise from the combustion chamber, giving up their heat to the closely grouped vertical tubes, pass over the bridge wall, and a large number of their remaining heat units are absorbed by the relatively cool water flowing slowly up through the economizer sections.



Assembly of piston, crosshead, connecting rod with roller bearing at big end, and crank shaft showing counter-weights

From the foregoing description it should be noted that the Doble generator possesses the most distinctive advantages of both the fire-tube and flash boilers.

The excellent heat transference conditions, and the large reserve of water heated to the steam temperature, are true of the former. The progressive flow of the water counter to that of the gases, with no circulatory flow, and the all steel construction with its consequent immunity from leaks due to low water, duplicate the most desirable features of the flash type.

The normal steam pressure in the generator, while power is being used, is 600 pounds, which means a terrific acceleration with the opening of the throttle. Pressure is maintained at this point by an automatic device which cuts off or renews the fuel supply according to the variation of the pressure from normal.

Every section of the generator is tested to withstand an hydraulic pressure of 5000 pounds, and the actual bursting point is over 8000 pounds.

To prevent any possibility of an accident to the generator tubing a safety valve is also attached, which operates if the steam pressure reaches 1000 pounds.

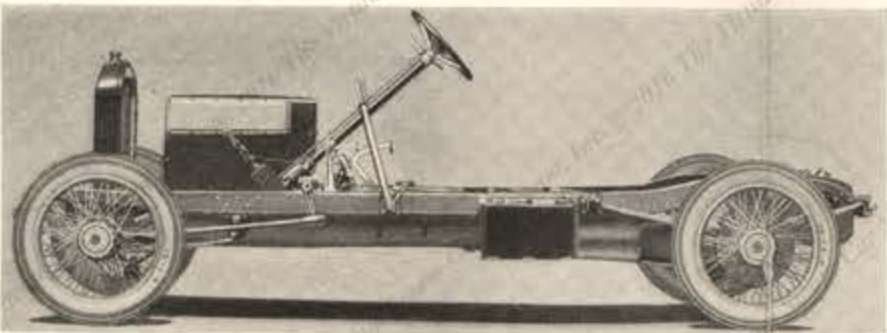
The live steam is led from the upper headers of the generator into a manifold, passes through the throttle valve, and down to the steam chest of the engine.

The exhaust steam from the cylinders is carried to the top of the radiator, and is forced down through it by the pressure of following steam. A honeycomb type radiator is used, thereby obtaining approximately six times the radiating surface of the type which was formerly used on steam cars.

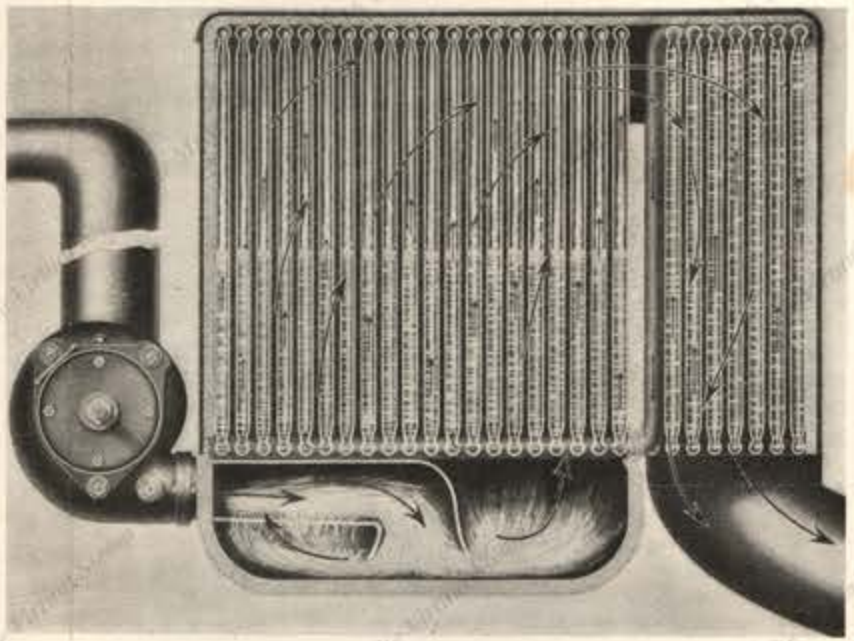
The water of condensation enters the water tank very near the bottom, so that any steam that might find its way to the tank, is at once condensed in bubbling up through the water. This will occur only when accelerating rapidly from a slow speed or pulling slowly on a heavy road. If the unfavorable condition of slow, heavy pulling continues for some time, a small part of the steam will remain uncondensed. To guard against any accumulation of such steam a vent is provided in the top of the water tank.

This system of condensation is so effective that a Doble car will run approximately 1100 miles on one filling of water.

The lubrication of the throttle and cylinder valves, the cylinder walls, the interior of the generator, and the water pumps, is accomplished by the addition of a small quantity of standard cylinder oil to the water.



Doble Chassis—75 h. p.—weight 2400 lbs. The steam generator is located directly behind the radiator; the water tank is below the front foot boards; the rear end of the crank case is integral with the rear axle housing; the kerosene tank is between the rear springs



Doble Steam Generator—Sectional view. Large arrows indicate flow of gases of combustion—small arrows indicate flow of water. Water enters the lower headers of the Economizer Sections, shown at the right. Steam leaves the upper headers of the Evaporating Sections, all those above the combustion chamber

The oil is pumped into the generator along with water, and there performs several valuable functions. First it thoroughly coats every portion of the interior of the generator with a very thin coating of oil. While this coating is exceedingly thin at ordinary temperatures, it is very much thinner at 485 degrees F., which is the approximate temperature of the generator at 600 pounds' pressure.

No scale will stick to a surface coated with oil, therefore the interior of the generator is absolutely protected from accumulations of scale, as well as from rusting.

A second function of the oil is to prevent particles of scale from adhering to one another and finally clogging some passage. This is effectually accomplished by the oil thoroughly coating each particle of scale as it is thrown out of solution and thus rendering it incapable of sticking to any other particle.

This action appears to be extremely thorough, and in several years' use no accumulation of scale can be detected in any portion of the generator.

As the bubbles of steam break through the water surface, they take a certain amount of oil along with them, thus lubricating the throttle valve, and then the valves and pistons of the engine.

The condensing system, previously described, saves the oil along with water, and as the oil is never exposed to a destructively high temperature, none is lost due to heat.

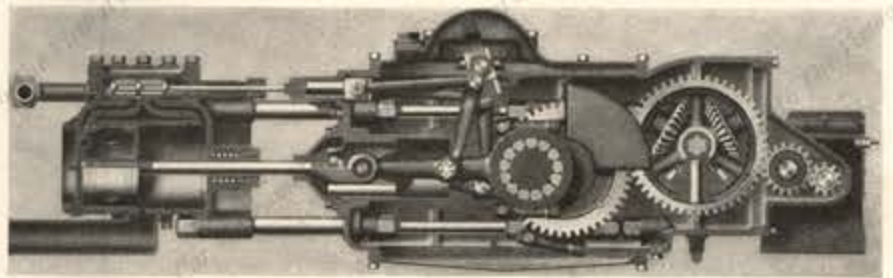
Lastly there is no contamination of the oil, by gasoline, carbon or road-dust, as in an internal combustion motor.

The result of the foregoing conditions is that a Doble Steam Car will use only one gallon of oil in running 8000 miles.

For the same reason the oil can be added to the water and freezing, just as in the cooling system of a gas car.

THE engine used in the Doble power plant is exceedingly simple and contains but eleven moving parts. The dimensions of all the working parts are ample to insure uninterrupted service under maximum conditions of load.

It is a two-cylinder, single expansion, double action engine. The uni-flow principle is employed in order to provide the high expansion desirable, with a noiseless valve gear and only one valve per cylinder. The valve takes care of the steam inlet, while the exhaust passes out through ports uncovered by the piston at the end of the stroke. It is thus possible to secure cut-off at 5 per cent of the stroke, if desired.



Doble Steam Engine—Sectional View

KEROSENE is used both for starting and running; the burner is electrically ignited; every trace of flame is completely enclosed in the combustion chamber; there is no pilot light; combustion is so complete that no soot is ever deposited on the generator tubing; sufficient steam for running may be generated from perfectly cold water in less than a minute.

Air, drawn through the radiator by a small electrically driven multivane, passes the spray nozzle a sufficient velocity to draw out the kerosene and atomize it. This velocity immediately decreases due to the widening of the venturi tube and the fuel mixture is ignited by an electric spark. As soon as the burner is lighted the spark ceases automatically. The combustion takes place in a chamber made of a special refractory material, which attains a very high temperature, and positively insures complete combustion by heating the gases before they burn, and by its very effective catalytic action.

The quickness with which steam may be generated in the Doble plant requires a word of explanation. It is due in part to the high temperature attained in the combustion chamber and to the unusually large heating surface of the generator tubing (one hundred and fifty square feet); but most of the time saved in starting, as compared to other steam cars, is due the elimination of the time formerly required for heating the vaporizer preparatory to lighting the main burner.

S P E C I F I C A T I O N S

<i>Engine</i>	Two cylinder, uni-flow, double action, single expansion. Stroke 4"—Bore 5".
<i>Valves</i>	Inlet—2 piece slide valve. Exhaust-ports uncovered by piston.
<i>Valve Gear</i>	Doble type.
<i>Crank Shaft</i>	One piece, drop forging, with crank-pins 2½" in diameter. Balanced.
<i>Combustion System</i>	Doble type. Kerosene only fuel used. Electric ignition.
<i>Steam Generator</i>	Doble type—75 h. p.—150 sq. ft. heating surface.
<i>Ignition and Lighting System</i>	Delco.
<i>Axles</i>	Front and Rear—Doble-American Ball Bearing Co.
<i>Water Pump</i>	Crank driven plunger pump.
<i>Water Tank</i>	20 gallons.
<i>Radiator</i>	Honeycomb, 4" core.
<i>Kerosene Tank</i>	25 gallon tank, mounted at rear of chassis. Air pressure, 3 pounds.
<i>Bearings</i>	Crank shaft, big end connecting rod and main bearings are annular roller. Front Axle—Annular ball, Hess-Bright. Rear Axle—Annular roller, Bower type.
<i>Wheelbase</i>	128".
<i>Tread</i>	Standard.
<i>Driving Gears</i>	Spur type, engine to axle, 47 to 49 ratio.
<i>Wheels</i>	Rudge-Whitworth wire wheels.
<i>Tires</i>	Goodrich Silvertown Cord 33" x 5".
<i>Steering Gear</i>	Gemmer model "K," heavy duty type.
<i>Drive</i>	Steering wheel and hand brake lever on left side.
<i>Brakes</i>	Two expanding brakes—16" drums, completely enclosed. Service brake—hydraulic-type—operated by foot pedal. Emergency brake—hand lever.
<i>Springs</i>	Semi-elliptic, Front 44" x 2"—Rear 56" x 2½". Rebound shock absorbers.
<i>Frame</i>	6" deep. Heat treated alloy steel.
<i>Weight</i>	3500 pounds.
<i>Bodies</i>	Seven passenger touring body. Three passenger roadster. Special bodies as listed below can also be furnished. Four passenger sporting type. Four passenger collapsible coupe. Town coupe.



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