Stanley's dream makes a comeback

Decades behind the internal-combustion engine, steam cars are coming up fast on the outside

by Edward Gross

GM Research

Engineers install steam in a modified Pontiac.

Shortly before the turn of the century, the great automobile race began. Three types of engines pulled away from the starting gate: internal combustion, steam and battery. For a while all three were fender to fender, but then the internal-combustion engine began to pour on the gas and pull ahead. By World War I, it had left all its competitors choking in its exhaust.

And by the 1960's, it was doing the same thing to American cities, and a brand-new race had begun.

Singled out as the chief villain in air pollution, the internal-combustion engine looks behind today and sees the steam car—although 20 years back—in serious pursuit. Promising the same or greater efficiency, less noise, less cost and less pollution, the steam engine is once more a legitimate rival, made more so by President Nixon's August promise of Federal aid for the development of unconventional car engines.

Although technology of the steam car grew rusty in the past seven decades, and the effort expended on it came nowhere near that lavished on the internal-combustion engine, work did not cease entirely. Steam cars continued to be produced right up to today, although commercial production ceased after 1925.

The most celebrated steam car—though no more than 12,000 were sold—was the Stanley Steamer invented by the Stanley brothers and produced until 1925. Its most memorable achievement came in 1906, when the wheeled tea-kettle set an automobile speed record of 127.66 miles per hour.

Another steam car, the White, produced by the White Sewing Machine Company from 1901 to 1910, made an important contribution when it extended water mileage from 40 to 100 miles by installing a condenser so water could be recycled. It was followed by the Rolls Royce of steam cars, the Doble, named for its inventor Abner Doble. Thirty-five Dobles were produced from 1910 to 1934, but their importance lies in the advances they made in steam car engineering and ease of operation. Further improvements were incorporated in the 1953 Paxton, which was only shop-tested, and the single Williams (Williams Engine Company, Ambler, Pa.) built in 1960 and still in operation today.

The reasons for the first steam cars' demise and the internal-combustion engine's ascendancy include short water mileage, boiler explosions, long and arduous start-up time, complicated operation and not least of all, lack of mass-production techniques which could have brought down the cost.

But if it is now true, as ROAD TEST magazine contended in February 1968, that ". . . there is no doubt that the technology is here today to build a steam powered car equal to or better than the internal-combustion engine car," then what stands in the way?

Detroit for one. The auto makers have an estimated $8 billlion invested in present production facilities, too much to scrap for steam car production. And the high entrance fee has precluded outside competition. Based on joint hearings in May 1968 before the Senate Committee on Commerce and the Subcommittee on Air and Water Pollution, in which leading engineers and representatives of the auto industry testified, the Senate Commerce Committee issued a report in March criticizing Detroit's "myopic persistence" in holding up the development of a steam car and concluded that such a car "is a satisfactory alternative to the present internal-combustion engine."

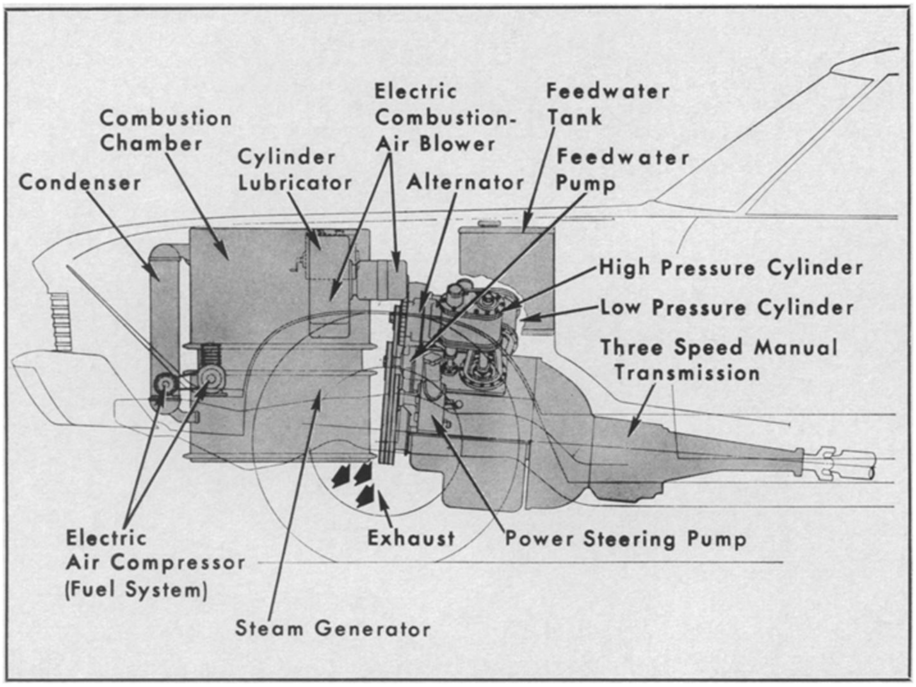
Ever conservative—if not downright hostile—the auto makers contend that a steam car would cost more, weigh more and be larger than a conventional auto.

But there are two sides to that.

Dr. Robert U. Ayres of International Research and Technology Corp., a Washington, D.C., consulting firm, argues that because of simpler construction—steam cars would have fewer parts—they would cost less to produce. As for weight and size, these two drawbacks were caused by the bulky steam generator (boiler). The use of small diameter tubing could reduce boiler size as could using molten salt as a heat reservoir since less steam would be necessary to produce heat energy, hence less bulk. In short, no new fundamental research is needed, only a little work in design to make a steam engine the size of an internal-combustion engine.

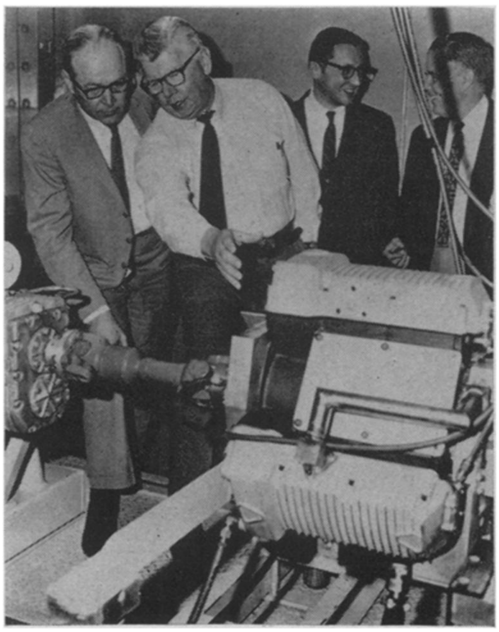
Further, by heating water in a coiled tube rather than a kettle-like boiler, tubed steam generators eliminate the danger of boiler explosion, something accomplished by Abner Doble in 1917 but which steam critics still allude to.

The principle of the steam car is a



GM

General Motors' experimental SE-124 with Besler engine installed.



Lear Motors

Lear shows his pacemaking Delta.

Setting up a modern boiler for testing.

simple one. The heart of the car is the boiler, the condenser which reforms the used vapor into water, and the water tank which stores the water before sending it to the boiler. To operate, a driver turns a key which sprays fuel from a nozzle under the boiler, simultaneously touching off a spark which ignites the fuel, presumably kerosene or diesel oil. Once the fire is going, a minimum wait of 20 seconds is needed for the water to vaporize to steam, which either drives a piston or a turbine. The expended steam is collected in the condenser.

Not only is the conventional auto transmission eliminated this way but since the engine can provide instant reverse action, mechanical brakes would no longer be needed except to keep the car parked. Furthermore, since the fuel is almost completely burned, carbon dioxide and water are the only end products.

Another problem critics cite is freezing in winter. No problem, say proponents; merely keep a pilot light or small immersion heater going for the water. For the condenser—the equivalent of a radiator—bypass valves could reduce the amount of heat lost through radiation by reducing the amount of steam passing through the condenser. Antifreeze is also a possibility, but fluids that will not decompose at high temperatures must be found.

William P. Lear, industrialist, inventor and head of Lear Motors Corp., Reno, Nev., claims he is on the verge of developing one—a derivative of anomalous water (SN: 12/21, p. 615) —that can withstand intense heat and cold. He calls it Learium, and hopes for ways it can be produced in useful quantities.

He expects his substance—a viscous fluid good from 50 degrees below zero F. to 750 degrees above—to be a substitute for the water, not an additive.

The most mentioned way to overcome freezing, in fact, is substitution of an alternative fluid for water. Freon, a fluorocarbon used as a refrigerant, freezes at minus 68 degrees F. and is the most popular candidate. But not only the major auto makers but Lear, who has spent more than anyone—$10 million—to develop an efficient steam engine, condemns Freon. The reason: At temperatures above 290 degrees F., it decomposes into phosgene and hydrogen chloride. Toxicity is the concern here coupled with damage to metal parts. However, heavy benzene hydrocarbons, such as hexafluorobenzene, along with Lear's polymerized water, are being considered as substitutes for Freon.

Despite this concern, the U.S. Department of Transportation in February awarded Dallas, Tex., $310,000 to develop a bus powered by an external-combustion engine using Freon. The award followed by three days a similar one to the California State Committee on Transportation for a research and development demonstration project using steam buses in San Francisco and Oakland.

Because of the cost of Freon or other additives, as well as any hazards involved, the steam system in a car must be hermetically sealed like a refrigerator and its components of adequate size to prevent fluid loss or venting. Using Freon it was believed would necessarily increase the size of the condenser, thus making for a bulky engine.

However, a spinoff from the Apollo Program—a jet condenser that instantly converts steam to liquid—promises to reduce the bulky condenser. Planning Research Corp. and STP Corp. submitted a proposal in April to the National Air Pollution Control Administration for a design study of a steam car utilizing the advance. It was the National Air Pollution Control Administration this July that awarded the first Federal contracts for the development of a steam car engine for passenger cars.

The administration awarded $174,000 to the Thermo Electron Corp. and $97,000 to Marquardt Corp.

The road to a steam car—although it is a long and complicated one—can be traversed, as the evidence shows. No one is more aware of this than the auto companies. And though they are committed to defending the internal-combustion engine and maintain that the solution to air pollution is further improvements in it, they are by no means playing ostrich.

General Motors has two experimental steam cars—one a Pontiac with a GM-built steam engine and the other a Chevrolet with a steam engine made by Besler Developments, Inc., of Oakland, Calif. Ford is in the midst of a two-year contract with Thermo Electron Corp. in Waltham, Mass., to develop a small piston steam engine. Ford has agreed to put $1 million into the project (SN: 4/13/68, p. 357). American Motors is willing to admit it is also pursuing a steam program.

But the steam engine isn't alone in the race against the internal-combustion engine. It has to compete as well against the gasoline turbine engine and the electric car.

"I would have to rate the electric car number three," says Dr. Ayres, "because of limited marketing. The turbine is getting more attention and investment so it may get there first. If given equal attention, the steam engine would be a more appropriate animal for automotive applications."

Just how well the steam car fares will in part be judged on tests to be started this month by the California Highway Patrol. The patrol intends to equip two cars with two types of steam engines—one a piston engine developed by Thermodynamic Systems, Inc., of Newport Beach, Calif., and the other a steam turbine to be supplied by Lear Motors sometime in mid-1970. The tests, which will run for six months, will be the first using truly modern steam engines.

As to the final outcome of the great auto race, Prof. Ernest S. Starkman of the mechanical engineering department at the University of California at Berkeley says, "To be completely honest, the outlook at this point is negative. In the cold clear light of dawn, one must assess the system on the basis of thermodynamics, economics and social factors. Performance and economy must be considered along with weight and cost factors, and most importantly, public receptiveness to a relatively radical departure in power plant technology. And after all these items have been carefully considered, my enthusiasm somehow wanes." ◇