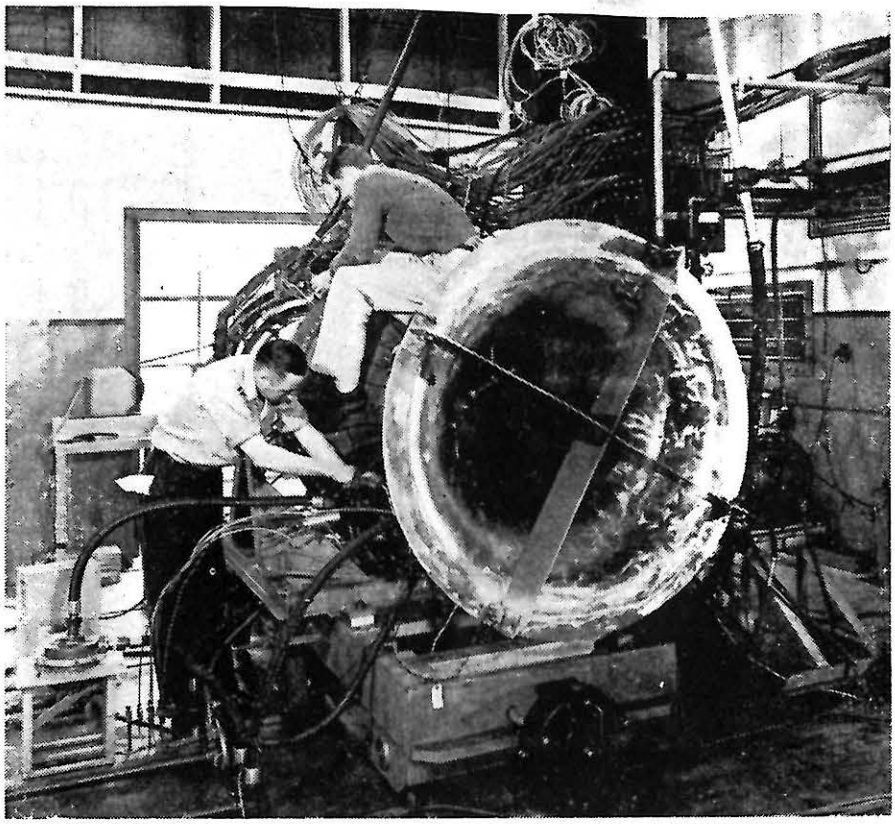
# Packard Concentrates on Turbine Engines

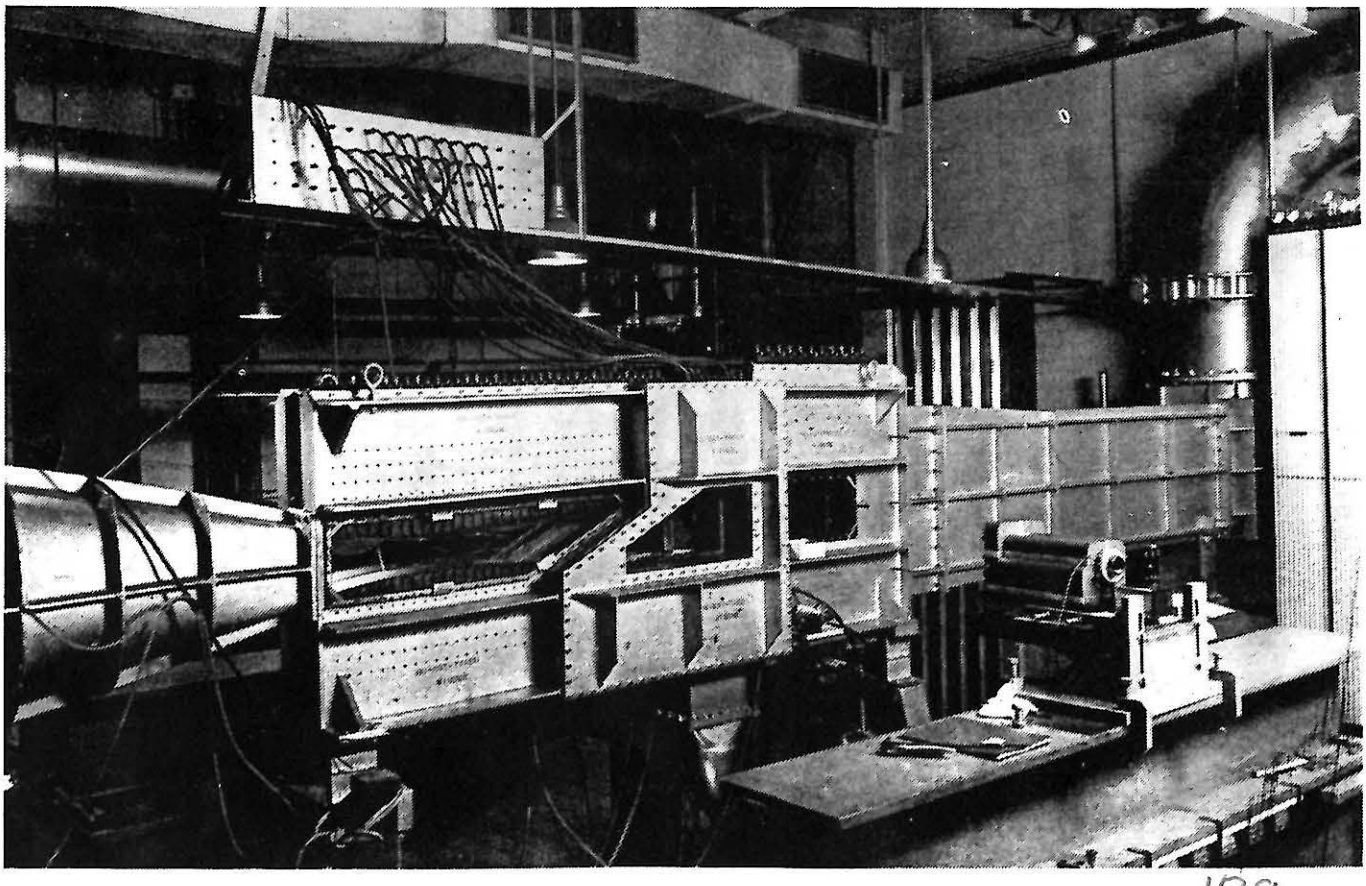


COMPLETION of $10 million facilities for the exclusive development of gas turbine and related types of engines at the Toledo plant of the Packard Motor Car Company has been disclosed. It was revealed that secret work on new aircraft power plants and guided missiles has been under way at this establishment since May, 1945. However, the full facilities for specialization in gas turbine research have just been installed.

Some of the nation's leading engineers head up the experimental and developmental work. They include Arthur Nutt, director of aircraft engineering and manager of the facil-

LEFT: A lightweight gas turbine aircraft engine is shown being installed on a thrust-measuring test stand in the Packard plant. Thorough performance investigations require a multitude of thermodynamic measurements as may be seen from the numerous instrument connections.

BELOW: Some of the instruments and equipment for photographing air flow phenomena are seen in the close-up of a supersonic wind tunnel. Glass panels, each nearly an inch thick, permit the camera, mounted on the heavy beam in the right foreground, to picture air travelling at supersonic velocities.



ities; C. E. Mines, co-ordinating engineer and assistant to the manager; Robert M. Williams, chief engineer; and C. P. Weedman, administrative engineer.

Only 150 persons were assigned three years ago to the new program, but today there are more than 550.

Packard's Toledo facilities consist of nine modern buildings containing 367,910 sq. ft. of floor space. The buildings, a sharp contrast to the small shed in which the work originally began, are located on a 79.3-acre flat field about six miles northwest of downtown Toledo.

Some of the buildings were occupied by the Aviation Corporation, New York, until August, 1943, when Packard took possession for the production of Rolls-Royce aircraft engine parts and advanced development of Rolls-Royce engines.

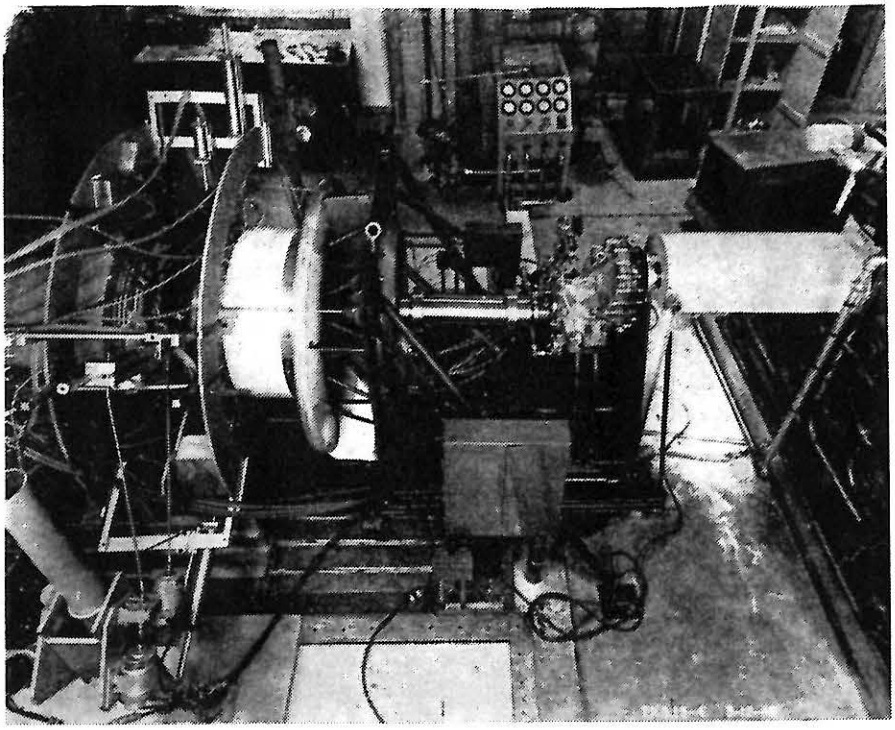
In May 1945, the experimental gas turbine program was approved. Packard completed its war production of 56,000 Rolls-Royce engines shortly after V-J Day. By that time, the gas turbine work was well under way.

According to a statement by Mr. Nutt, "Main units of the gas turbine engine are the compressor, combustor and turbine. The net output equals the difference between turbine and compressor power. Effects of each unit on the others preclude accurate analysis of a complete powerplant. Therefore, each unit — and the various parts of each unit — must be tested and developed individually."

Among the various laboratories are those having to do with electronics, instrumentation, mechanical accessories, burner research, fuel flow, stress, turbine wheel and blade test, air flow, metallurgy, heat treat, combustion and many other fields. There are numerous test cells; several shops, such as those for sheet metal, machining, and tool and die work; and a large spin test pit with a drive turbine that will support assemblies weighing up to 1,000 lb. and driven at speeds up to 25,000 rpm.

Dynamometers in the Toledo plant can absorb up to 8,000 hp. Air handling and refrigeration equipment can simulate altitudes up to 50,000 ft. in tests on jet engines developing powers required in modern fighter planes. As many as 270 separate test measurements can be made on an engine at the same time.

Three wind tunnels of unusual interest are used for experimentation at the Toledo plant — two supersonic and one "vortex" (or whirlpool design). Artificial wind is forced through these tunnels, and objects are placed therein for investigation of the air flow around them and the aerodynamic forces exerted upon them.



ABOVE: Aerodynamic tests of the complete turbine. The framework at the left carries remotely controlled motors which position the temperature and pressure instruments inside the turbine housing, while the shaft and gear-set in the centre transmit the turbine power to a dynamometer at the right. RIGHT: Vibration tests of turbine blades. Specialists are pictured using a high-frequency stroboscope lamp to observe a blade in motion on a powerful magnetic vibration.

The larger of the supersonic tunnels is 70 ft. long, with a maximum circular diameter of 54 inches. First of its kind ever built, it is powered by electric motors capable of developing 4,200 hp.

This supersonic tunnel was designed to test some of the large single components of jet engines, or assemblies of two or three related items, depending on the size and nature of the items and type of test involved.

It also can be used with vacuum pumps, which then permit the handling of 115,000 cu. ft. of air per minute. This amount of air is roughly equivalent to the emptying of 32 standard railroad boxcars (each containing 3,600 cu. ft. of space) of air per minute. Photographs are made of air trails around the test object, with a special light source and a camera designed for the purpose.

The "vortex" tunnel is another intriguing device at the Toledo plant. The effect of its use can be likened to that of directing wind on a pinwheel. The blades of a pinwheel rotate fast or slow when air blows upon them, depending on the position of the blades with relation to the air stream. The correct position of the stator blades in directing the hot gas to the turbine wheel to obtain the best result is determined in the vortex, or whirlpool, tunnel.