ORDNANCE

3,000 Miles-an-Hour!

Two new wind tunnels can produce speeds up to four times the speed of sound. One is for bombs, the other for ballistics.

See Front Cover

➤ TWO WIND tunnels costing a total of $2,000,000, that will produce speeds up to four times the speed of sound, about 3,000 miles an hour, have been dedicated at Aberdeen, Md., to the purposes of peace. The supersonic wind tunnels, one for bombs (shown on the front cover of this SCIENCE NEWS LETTER), the other for ballistics, are a part of the Army Ordnance Research and Development Center of the Aberdeen Proving Ground. Research work sneaked in before calibration of the bomb tunnel was completed saved the Army more than the cost of the entire installation by showing that a new 10,000-pound bomb, soon to go into production, was unstable. Other research at the wind tunnel has added 3,000 yards to the range of the 155-millimeter gun by changing the shape of the projectile.

Peacetime applications of the new wind tunnels are vast, reports Lt. Gen. L. G. Campbell, Jr., Chief of Army Ordnance. While the tunnels will be used in the remaining months of the war and for some time afterwards, for the development of new forms of bombs and rockets to improve accuracy, and to create guided missiles that may travel at extremely high speeds, they will also be available for nonmilitary research, Gen. Campbell believes. Within five years after the war, he predicts, 75% of the experiments carried out in the wind tunnels will be of a peacetime character. In addition to the Army research, the tunnels are now used by the Navy and the National Advisory Committee for Aeronautics.

The bomb tunnel and the ballistics tunnel are both contained in a new three-story brick building. The bomb tunnel is designed to produce air speeds up to 1.7 times the speed of sound, or about 1,300 miles an hour. When completed, the ballistics tunnel will provide air speeds of about 3,000 miles an hour. Both tunnels are a part of one closed circuit through which compressed air is forced by a five-unit power plant developing 14,000 horsepower.

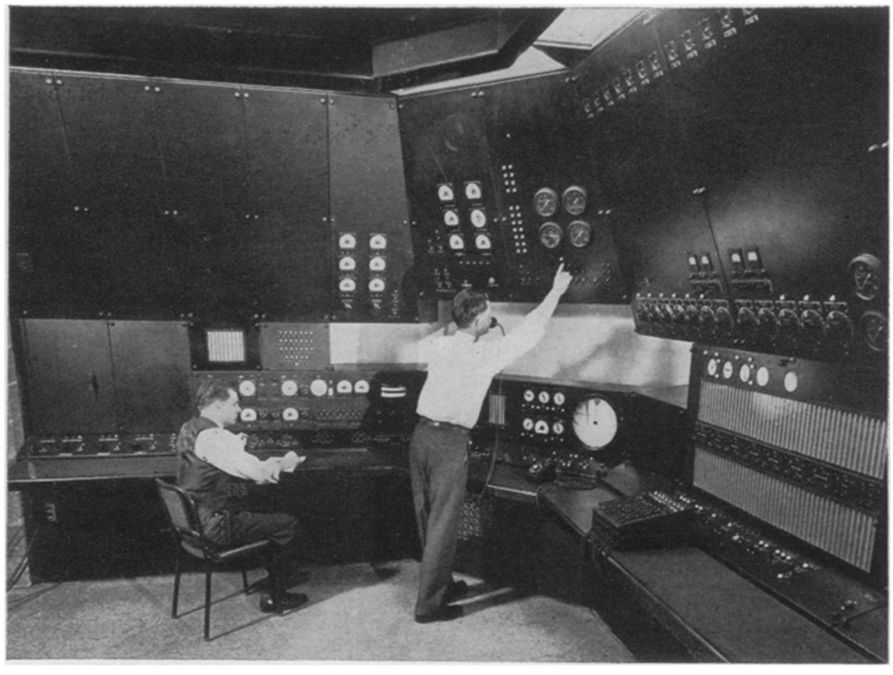
At supersonic speeds, the size and shape of a nozzle determines the speed attained. Nozzles are placed in the wind tunnel directly in front of the test section in which models to be examined are placed. In the bomb tunnel, this nozzle must be changed to attain different supersonic speeds. In the ballistics tunnel, a flexible throat nozzle is being installed so that air speeds may be changed by closing or opening it. This throat is made of long strips of quarter-inch steel plate, and the speed is changed by power-driven jacks which can close it to a one-inch aperture or open it to an 18-inch aperture. Thus it will be possible to reproduce speeds to which a projectile is exposed through its entire trajectory.

The test sections of the two tunnels are a little over a foot wide and a little under two feet high. In these sections on a special mounting rod are placed exact scale models, constructed of brass, of the item to be tested. These models can be nearly a foot long. Observation ports made of heavy glass, about a foot and a half in diameter, permit observers to view the model at high speeds and to photograph the airflow pattern around the projectile. Temperature in the bomb tunnel during tests is about 100 degrees below zero Fahrenheit.

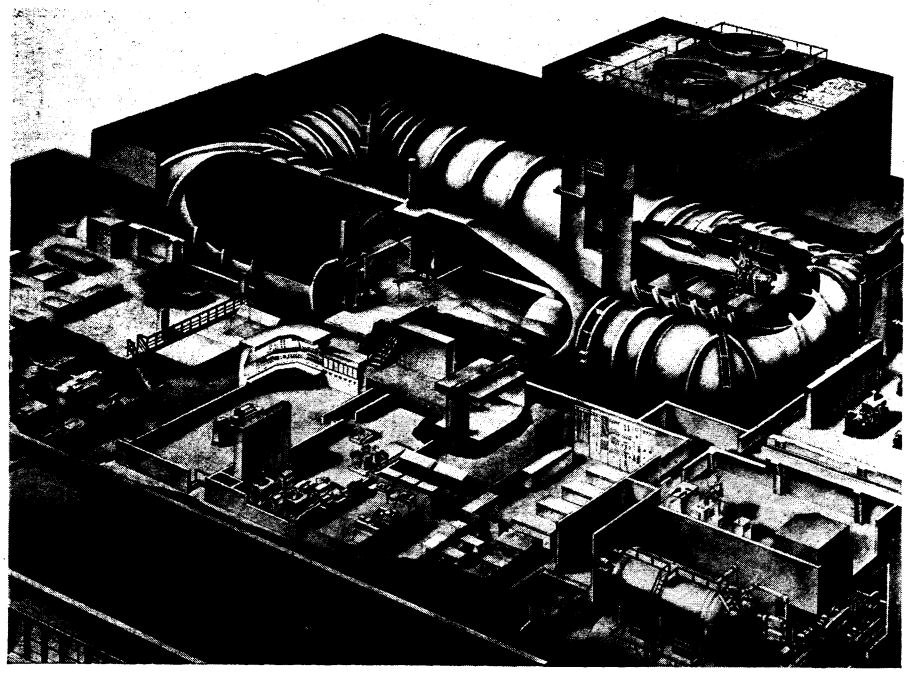
Instruments connected to the wind tunnel measure the three highly important factors in free flight of projectiles: lift, drag, and righting moment. Simply defined, lift is the force perpendicular to the projectile's path; drag is the retarding effect of the air; and righting moment is concerned with the true flight or stability as indicated by whether it yaws or tumbles.

In the wind tunnel the projectile is held still and air is blown past it. By the only other method used for checking on new designs, a ballistics range, the projectile has to be shot through the air and photographed in flight by high speed cameras.

The new wind tunnels were first suggested in 1940 to the Ordnance Department by Prof. Thedor von Karman of the California Institute of Technology who was a member of the scientific advisory committee of the ballistics research laboratory of the Ordnance Department. A board of the National Academy of Sciences with Dr. W. F. Durand, noted hydraulic and jet propulsion expert, as chairman, and made up of Dr. Hugh Dryden, of the National Bureau



REGULATES TUNNEL—Operation of the variable wind tunnel is regulated and observed by technicians manning this giant console, adjacent to the tunnel.



TESTS PLANES—Cutaway view of the giant new wind tunnel soon to be in operation at Buffalo which is capable of testing model airplanes at the lightning speed of jet propulsion at pressure conditions simulating 35,000 feet altitude. The tunnel contains an air volume of 210,000 cubic feet, equal to the cubic air volume of 16 six-room houses.

of Standards, Dr. F. R. Moulton, well-known astronomer, and Dr. Gano Dunn, electrical engineer, coordinated the development of the tunnel. A model tunnel was built at California Institute of Technology and this model was used for the basic design of the present tunnels. Construction took about one year. The wind tunnel laboratory is under the direction of Dr. Edwin P. Hubble, noted astronomer of the Mt. Wilson Observatory, on loan to the War Department for the duration. Research is supervised by Col. George G. Eddy, Director of the Ordnance Research and Development Center, who works directly with Maj. Gen. G. M. Barnes, Chief of the Research and Development Service of the Ordnance Department.

Science News Letter, May 26, 1945

PHYSICS

Wind-Tunnel Tests Speeds Up to 740 Miles an Hour

➤ A NEW $2,500,000 variable-density wind tunnel, capable of testing model airplanes at the 740-mile-an-hour speed known as "speed-of-sound" range, has been revealed by G. W. Vaughan, president of the Curtiss-Wright Corporation. The wind tunnel, largest of its kind in the nation, can be used to test jet-propelled airplane models with wing-spans up to 10 feet under atmospheric pressure conditions comparable to those found at 35,000 feet above the earth, about four pounds to the square inch.

Designed with the cooperation of the California Institute of Technology, the new Curtiss-Wright wind tunnel will enable engineers to test models of all types of planes, thus accomplishing in one place work which previously has been performed in three or four tunnels. This is made possible by the mammoth tunnel's extreme flexibility of testing range.

The operation of the tunnel is fundamentally simple. When engineers are ready to gather data on a plane, a model of the plane, exact to one thousandth of an inch, is installed on a test platform in the 8½ by 12 foot test chamber and air is set in motion by two 16-bladed, 22-foot diameter fans working in tandem. Wind may be blown to stimulate winds up to many times tornado speeds. Thus aerodynamic forces created are like those experienced by an actual plane in flight. By using a nozzle in front of the test chamber, air at high speed can be compressed further, creating a stronger blast.

At the control panel, an operator records the air load forces simultaneously by punching a button which causes the measured forces to be computed on perforated cards. Data on the punched cards later are appraised to determine full-scale airplane characteristics, thus eliminating possible errors in design long before the actual construction of the plane.

The overall length of the tunnel is 178 feet. Its overall width is 81 feet. It stands 36 feet from the ground at its maximum height. A 115,000-volt power supply is needed for the tunnel for use with the 14,000 horsepower drive motors that turn the big fans. Employing four special compressors, air in the tunnel may be pumped to four times atmospheric pressure, or 60 pounds to the square inch. Three-quarter inch steel used in the building of the shell of the tunnel is similar to that used in the construction of a heavy U. S. destroyer.

Science News Letter, May 26, 1945

CHEMISTRY

Chemical From Mushrooms For Treating Poison Ivy

➤ A CHEMICAL from mushrooms may in future become a remedy for ivy poisoning, Prof. Irwin W. Sizer and Clemens E. Prokesch, of Massachusetts Institute of Technology, report in *Science*.

The chemical is tyrosinase, an enzyme found not only in mushrooms but other plant and animal tissues. It is the one responsible for darkening of potatoes and bananas when left exposed to air.

One of the better methods of treating skin poison ivy, the scientists point out, involves oxidation of the poison with strong oxidants such as ferric chloride and potassium permanganate. Believing that the same results might be obtained with innocuous agents such as enzymes, the scientists tested the effects of tyrosinase.

In four of their numerous experiments, they put poison ivy plus tyrosinase on the skin of human volunteers for four hours. Another part of the skin was treated in the same way except that the tyrosinase had first been inactivated by boiling. The area treated with the active enzyme showed much less skin irritation than the control area treated with the inactivated tyrosinase.

"If successful results can be obtained in the future by applying the enzyme some time after the toxicant (poison ivy irritant) has reacted with the skin, even after erythema (reddening) has been produced," the scientists state, "then a new method of treating poison ivy dermatitis will be available."

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