Oil Burning Airplanes for Future

Aviation

America's first Diesel or oil-fueled airplane engine which flew from Detroit to Langley Field for its first public inspection by leading aeronautical experts may be the first of a new breed of aeronautical power plants that may drive the gasoline-carburetor sort of engine out of the sky.

For several years the Packard engineers under the direction of Capt. L. M. Woolson have been developing the new engine that has just been allowed to perform in public. The ordinary person would not give it a second glance, so conventional does it seem in outward appearance. But to the engineer who has seen Diesel engines capture the propulsion of sea-going ships from steam turbines, who has watched the application of oil engines to power plants and sizable construction machinery, who has even seen the coming of Diesel powered automobile trucks, the Packard engine consuming the sort of oil that is burned in furnaces and driving a standard type airplane for six hours across country comes as a portent.

CAPT. L. M. WOOLSON, Packard engineer, under whose direction the oil-burning engine has been perfected, as he appeared at Langley Field after flying from Detroit in one of his planes.

Little wonder then that the pilots, research scientists and airplane manufacturers visiting the Langley Memorial Aeronautical Laboratory crowded around the Packard engine when its locked covers were unfastened.

Nine cylinders, air cooled, arranged radially, compose the Packard airplane engine. The familiar spark plugs and the carburetor so necessary on a gasoline engine are lacking. One valve in each cylinder head acts as air inlet and burned fuel exhaust. The fuel, oil instead of gasoline, is sprayed into the cylinder instead of being mixed with air and vaporized in a carburetor. The heat of compression of the squeezed air in the contracting cylinder ignites the oil sprayed into it. Thus electrical ignition is dispensed with. The engine is of the four-stroke type and operates at from (*Turn to next page*)

Nitric Acid Forming Gas Spread Death

Chemistry

Nitrogen oxide, reddish brown corrosive gas that is first cousin to nitric acid, was the deadly substance that spread disaster in the Cleveland Clinic explosion, in the opinion of explosive experts. When the mass of X-ray film stored in the basement exploded and burned in its confined quarters it gave off great volumes of at least two dangerous gases, nitrogen oxide and carbon monoxide. The explosive sort of photographic film is made of cellulose nitrate and is practically identical in composition with smokeless powder. Such films have been known to explode spontaneously on various occasions in the past and they can be easily ignited.

The most probable explanation of the cause and progress of the explosion was given by Dr. Charles E. Munroe, veteran chief explosives chemist of the U. S. Bureau of Mines, who is the inventor of the smokeless powder used by the Navy and who has investigated all the major explosion accidents of the past four decades. Basing his figures upon smokeless powder explosion experiments made at Edgewood Arsenal to ascertain the cause of powder disasters on Navy ships, Dr. Munroe explained that within less than a half minute after the explosion of photographic film the resulting gases must have been composed of over a third deadly carbon monoxide and about a tenth of corrosive nitrogen oxide. These gases, produced in large quantities, spread through the building. The secondary explosion was probably due to the ignition of an explosive mixture of the carbon monoxide with air.

Three forms of nitrogen oxide result from the burning of cellulose nitrate. First a colorless, harmless gas, nitric oxide, composed of equal parts of nitrogen and oxygen (NO), is given off, but this on contact with air oxidizes to the reddish brown active gas, nitrogen dioxide, which is composed of one atom of nitrogen united to two atoms of oxygen. Mixed with the nitrogen dioxide is another form of the same compound, nitrogen tetroxide, similar in color and evil properties and containing two atoms of nitrogen combined with four of oxygen. Nitrogen dioxide mixed with water forms nitric acid, one of the most vigorous of the acids.

Carbon monoxide is the colorless, odorless gas that is responsible for deaths when auto engines are allowed to run in closed garages. It is the product of any sort of incomplete combustion. How much damage can be attributed to it in the Cleveland Clinic disaster is problematical.

Bromine was blamed in early newspaper reports for the damage but experts can not see how it could have been present except in very small quantities in chemical laboratories. The nitrogen oxide gases look very much like bromine fumes and the effect on the victims is similar. Erroneous reports of the presence of phosgene, a colorless war gas, were flatly repudiated by chemical warfare authorities and the confusion probably arose in the minds of observers whose experience with gas attacks was obtained in the war. No war gases were stored in the Cleveland Clinic.

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A strange provision of nature protects the knob-cone pine of the Pacific coast: seeds of the cones are rarely discharged until the tree has been destroyed by a forest fire, when the heat liberates the seeds to establish new growth.

Oil-Burning Airplane Perfected—*Continued*

1700 to 2000 revolutions per minute with cylinder pressures as high as 1200 pounds per square inch.

For a given mileage the fuel cost is only about a sixth that of a gasoline fueled engine. The present design weighs about three pounds per horsepower, a remarkable record despite the fact that standard gasoline airplane engines weigh less than two pounds per horsepower. Engineers have estimated that for long flights the saving in fuel weight due to the use of oil instead of gasoline will make the Diesel engines more economical despite its heavier weight.

Starting a Diesel engine presents more difficulties than for a gasoline engine. Since the firing of the fuel mixture in the cylinder is accomplished by the heat of compression of the air, a much swifter kick must be given in starting. While the exact method of starting the Packard engine is not yet revealed, those who saw the Langley Field demonstration are of the opinion that the necessary impulse is given by the firing of a powder cartridge. Once the engine is warmed by running it can be stopped and started in the more conventional manner.

In the laboratory of the National Advisory Committee for Aeronautics at Langley Field a Diesel-type airship engine of six cylinders is now operating under test conditions. An ordinary airship carburetor-type gasoline engine was converted to burn oil as a result of the investigations on one cylinder oil engines that have been in progress for several years. This development will speed the application of oil engines to airships and possibly to automobiles.

The British are developing oil Diesel-type engines for their large airships now building. The Beardmore engineers in England have also given attention to the possibilities of oil-powered airplane engines. In Germany and France similar work is in progress, although details are lacking because of the secrecy that surrounds all investigations.

More than 4000 Diesel engines for power and other purposes are now being manufactured in the United States annually. Most of them are heavy in weight and over a hundred horsepower. The principle of the oil engine was invented by Dr. Rudolf Diesel, the German engineer-physicist, after which it is named. Dr. Diesel's death is still a mystery, as he disappeared from a cross-channel steamer en route to England just before the outbreak of the European war.

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Abyssinia's desire for an outlet to the sea has at last been satisfied through an arrangement with Italy to lease for 130 years a piece of land for a port on the Red Sea.

The Pageant of Astronomy

Astronomy

Willem J. Luyten, in *The Pageant of the Stars* (Doubleday, Doran):

Man cannot live by faith alone. Surrounded as he is by a world of facts, he seeks knowledge and understanding of these facts. On a knowledge of facts, however imperfect, man must build the superstructure of faith. His knowledge represents his determination to be fully conscious of the material universe; his faith represents his desire to be at peace with the spiritual universe. Civilization is man's effort to achieve such knowledge and to attain such faith. In the pursuit of these ends astronomy plays a unique and significant part, since it is the only science that deals with the material reality outside this earth.

Astronomy was born out of wonder at the mystery of the dark and starlit night, wonder at the countless host of stars, so familiar and yet so remote; that wonder which Plato called the soul of science. Emerging from this primitive wonder, astronomy has matured down the centuries, widening its scope as man's mind turned from itself to press on in its bold and undeterred quest of the boundaries of his universe, boundaries which have now receded so far that his knowledge of fact and his exercise of faith unite to set his finiteness in infinity.

Consequently, advance in astronomy is a phase of the advance of civilization—as man's outlook grew less parochial astronomy progressed from an anthropocentric to a geocentric point of view. At this stage it was sufficiently dominated by the authority of Aristotle, lingering throughout the Middle Ages, and by ecclesiastical interpretation of the Scripture, to postpone all further development until the general intellectual awakening of the Renaissance. It is no mere coincidence, therefore, that we find the formulation of the new truth in astronomy taking place simultaneously with the struggle for new ideas in religion. In 1512 Copernicus first published his views on the rotation of the earth and the central position of the sun in the planetary system—five years before Luther's dramatic gesture at Wittenberg. Copernicus's heliocentric system led to Newton's discovery and demonstration of the principle of universal attraction, and with this first expression of a perfect law of nature it may be said that astronomy came of age as a science. In the meantime the telescope had been invented, and its introduction into astronomy, coupled with Newton's law, entirely changed the aspect of our science. Naked-eye astronomy ceased to exist, the universe became increasingly telescopic, and as a natural consequence astronomy developed into a pure science, thus severing its connection with the theological view of creation. The next century saw the development of celestial mechanics and with it the desire to inquire into the motions of stars and planets; researches into the structure and the mechanism of the cosmos supplanted the former simple description of the visible heavens. Astronomy today is almost exclusively telescopic, the naked-eye stars constitute considerably less than one-millionth part of those that are now visible in our largest telescopes; the discovery of thousands of island universes and the introduction of the doctrine of relativity have entirely changed the concept of space. But in all this tremendous development we find unity: matter is the same everywhere, chemical elements, atoms, and electrons are the same in the stars and nebulae as on the earth, and they obey the same laws everywhere.

Through the introduction of giant telescopes and of photography, and through the application of modern physics and chemistry, new vistas have been opened far beyond the wildest dreams of our predecessors. At the same time, astronomy, though grown more diversified, has yet preserved the unity of its basic truths. Today more than ever before we stand silent in admiration before the truths unveiled by astronomy, before the unity of fact throughout creation.

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