

# Free Piston Engine Seen

Commercial production of small free piston engines for use in trucks and boats is close at hand

► THE FREE piston engine, which has appeared sporadically since the late 20s, may soon be used commercially in heavy trucks and boats.

Commercial manufacture of such small units is very close according to Prof. James S. Campbell of Free Piston Development, Kingston, Canada, which is working on a series of units in the 80 horsepower class.

"It is much more economical to run than gasoline engines and when commercially available should be up to 15% more efficient than the best diesel engines," Prof. Campbell said. In weight, the free piston unit falls halfway between the two.

If produced in the same quantities as present engines, the free piston unit, which is less complex, would reportedly be as much as 30% cheaper to manufacture.

Despite the fact that the free piston engines operating cycle is complex, its basic design is quite simple. It essentially consists of two facing pistons that float freely in a common cylinder. There are no piston rods or crankshafts.

Fuel is injected between the two pistons and ignited there. The resulting explosion violently pushes the pistons apart, compressing air at each end of the cylinder. By proper valving of the air, enough is retained under compression to force the pistons to fly back for a second injection and ignition, and so the firing cycle continues.

Motive power is produced by passing the compressed air and exhaust gases through a simple turbine.

The complete plant is akin to a boiler and steam turbine. The free piston engine generates the hot gases like the boiler and the turbine converts the energy into rotary horsepower.

According to the developers, the free piston engine can operate on all sorts of fuel, such as regular diesel, stove oil, JP4 jet fuel and a combination of lubricating fuel and ether.

The engine can be run at idle, full speed and back to idle as many as three times per second, Prof. Campbell said. This is done by changing the engine's compression ratio, cited as a major advantage of the free piston system.

Free piston research in England, the United States, France, Belgium, Germany and Russia has concentrated largely on the application of the engine to high-horsepower situations, up to the million hp range. The Canadian research effort has been chiefly directed toward smaller engines.

The idea of free piston engines was first explored in France in 1920 and patented in 1923. The only commercially successful units have been designed for stationary applications, although some have been built into compressors for use in construction and mining operations.

One of the reasons for the free piston engine's slow advance is its complicated thermodynamic cycle. Elaborate computer analysis is required for even small changes in design.

# Cobalt Increases Pond Life, Russians Report

► COBALT added to the diet of fishes and weeds is an efficient method of increasing the productivity of ponds, a team of Soviet scientists has reported.

Micro additions of cobalt into the food ratio of fish and plant life at the "Nive" and "Osenka" fisheries in the Voronezh and Moscow areas of Russia respectively have increased the content of plankton and other fodder organisms that are rich in Vitamin B-12.

Fish also apparently propagated and gained weight more quickly in cobalt-treated ponds, according to reports from the All-Union Institute of Pond Pisciculture, Grachev.



Boeing

LADY BUG, LADY BUG—Microelectronics research and development at the Boeing Company, Seattle, Wash., support company programs for space-age microelectronic guidance, control and communication. Thin film resistors on a silicon circuit wafer are so tiny they are dwarfed by a lady bug.