well be the most fruitful proving ground of public opinion for new body design.

Science News Letter, June 3, 1939

"Dope" Diesel Fuels

ENGINEERS and scientists are studying the increased performance of Diesel engine fuel when it is "doped" with acetone peroxide and ethyl nitrate.

The Dutch scientists J. J. Broeze and J. O. Hinze of the Royal Dutch Shell Laboratories showed that the addition of small quantities of these "dopes" makes the firing of the heavy oil in airplane Diesel engines easier. The molecules of the chemical dopes are easily activated and make the combustion of the charge of fuel in the cylinders occur more easily. Aim of the investigation is to retain the safety features of a heavy Diesel fuel and yet raise its firing characteristics.

Science News Letter, June 3, 1939

MEDICINE

Use Television Techniques To Detect Heart Ailments

A NEW kind of electrocardiograph machine using television principles, which will enable doctors to see the record of the patient's heart action instantaneously without waiting as is now necessary for a photographic film to be developed, has been devised by Dr. George Walker of the University of Kansas School of Medicine.

The familiar wavy line record is traced in bright green by a bright moving dot on a screen which is both phosphorescent and fluorescent. The moving dot comes from a stream of electrons from a cathode ray tube.

The machine is expected to save both time and money in getting records of heart action, important for diagnosing about 40 heart conditions.

It can be operated from any electric light socket in either hospital, office or home. It is not yet available commercially. The principle of this new machine has been adapted to use with the standard electrocardiograph machines now in use. This phase of the work was done by Dr. Graham Asher of the University of Kansas.

The exhibit of these machines, shown by Drs. Asher, Walker and Frank Hoecker, at St. Louis, was awarded a certificate of merit by the American Medical Association.

Science News Letter, June 3, 1939

Portugal rules colonies totaling 26 times its own area.

PHYSICS

Metal of the Future Has Extraordinary Stiffness

Beryllium, Now Very Scarce, Would Revolutionize Industry and Aviation If Ever Found in Large Quantity

WRITE this down in your future book: a metal not one person in ten thousand will ever see in pure form outside a museum and whose name you may never have heard is promising to improve the machines of our industries during the next decade.

Speedier, sturdier and safer airplanes driven by far more powerful motors; cheaper and safer machine tools; longer-lasting springs—these and hundreds of other boons may soon be conferred on twentieth century civilization by this metal.

Its name is beryllium. Though its commercial exploitation goes back not many years and its intensive study in the laboratory dates but to the post-war period, already it has aroused man's cupidity and a bitter international battle for its control, with ramifications reaching into the governments of a half dozen major powers.

It is being put into alloys whose performance makes beryllium a strategic material in the World War that has not yet begun, even though the amounts of beryllium in use must still be measured in pounds instead of tons.

A watch made of two alloys containing beryllium was dropped from an airplane 3,000 feet up. Only the crystal broke; the watch continued to run. Properly used springs made of one of the alloys have never broken or worn out from fatigue. Engine parts made of it can operate consistently at temperatures that would ruin the temper and shorten the life of any material now in use.

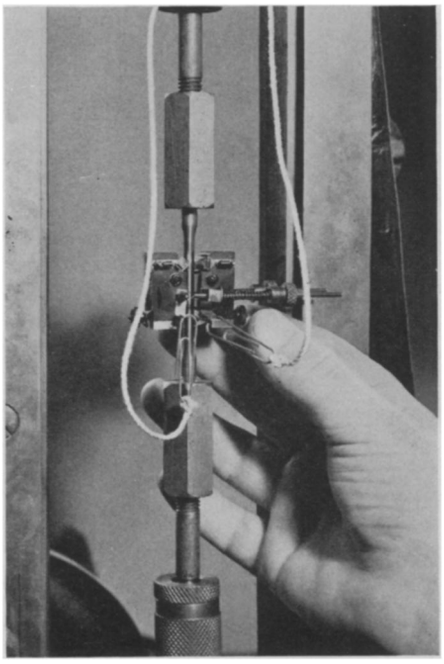
Beryllium is light and exceedingly hard. Added to other metals, it confers on them hardness and strength, turns soft copper into a ruddy alloy as hard as tool steel, with nickel makes an alloy as tough as the toughest steel and much harder. Some beryllium alloys laugh at corrosion as well; they are more rust-resistant than stainless steel.

A Frenchman, Vauquelin, found beryllium in 1798, but because it is difficult to extract from its ore, it remained a curiosity for a century and only the dreamer ever imagined it would some day become an object of painstaking attention. A decade ago, its price was more than $100 per pound of beryllium in the form of a master alloy with copper. Today the four per cent. beryllium master alloy sells for $15 a pound of beryllium—actually about 25 pounds of metal.

Beryllium is the fourth lightest element, only the gases hydrogen and helium, and a still lighter metal whose violent reactions with water make it unusable, lithium, coming before it in the periodic table. Though it is hard and takes a high polish and melts only at a high temperature, it is extremely brittle.

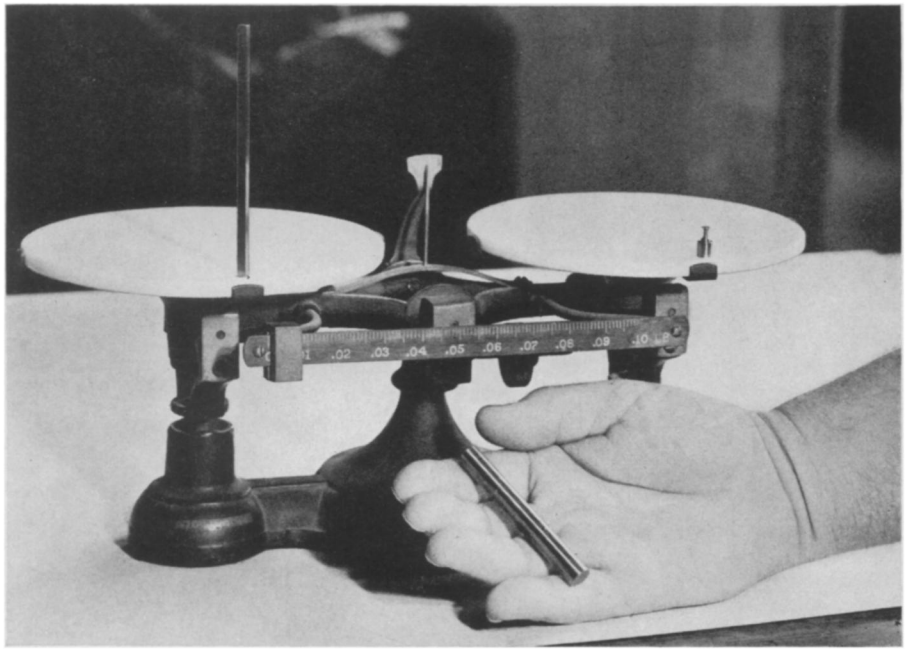
Beryllium copper, containing two per cent. of the new metal and, in some cases, a small percentage of nickel, is the beryllium alloy most widely used so far in the United States.

But in Germany, the giant Siemens-Halske firm has made an alloy of two per cent. beryllium and the rest nickel.



STRENGTH TEST

Beryllium is submitted to tests of tensile strength at the National Bureau of Standards. It is strong, but so little is available that even test samples are below standard in size.



EXTREMELY LIGHT

The sample of beryllium at the left fairly towers over the tiny brass weight which balances it. In the foreground is another tiny sample of the metal from the museum of the U. S. Bureau of Mines.

And from that alloy they have made parts for airplane engines and other parts finding their way into different corners of machine-minded Germany. In this alloy—and in an alloy of beryllium and iron to produce beryllium steel, a secret research project in half a dozen laboratories—there is promise.

Beryllium copper has a tensile strength of 185,000 pounds to the square inch. Beryllium nickel ranges between 260,000 and 300,000 pounds to the square inch! True enough, steels that strong exist, but they do not have beryllium nickel's hardness nor its corrosion resistance. Nor its wonderful property of keeping these same characteristics at temperatures as high as 400 degrees centigrade. Ask any engineer what that means: the airplane engine builder, the high speed Diesel designer and others whose business is rapidly moving machinery that heats up.

Beryllium copper is almost the modern equivalent of the legendary lost art of hardened copper. It may provide cheaper long distance transmission lines because of its great strength and high electrical conductivity.

The other beryllium alloy which may be superior even to beryllium nickel is beryllium-aluminum, consisting roughly of three quarters beryllium and the rest aluminum. Because beryllium is two-thirds the weight of aluminum, the alloy is substantially lighter than any material in use for aircraft structures. Early samples of the alloy were all extremely brittle, but secret projects in which military authorities the world over are keenly interested are said to be overcoming the difficulties.

Great strength far in excess of any usefulness can be had in many metals, but what the scientist calls the modulus-density ratio, that is, stiffness of the metal in relation to its weight, fails in most cases. This explains why some designers look with hungry eyes upon one of beryllium's properties, its enormous stiffness. If only it could be utilized.

Beryllium is normally brittle as glass. But a few small pieces of ductile beryllium have been produced. There are dreams that we shall learn how to make ductile beryllium just as drawn tungsten wire was achieved after being considered impossible for years. If non-brittle beryllium is made, will it retain its wonderful stiffness?

Though its manifold advantages would seem to promise it a rosy future, there are still many difficulties in the way of beryllium's use. Because of the exceptional hardness of its alloys, they are difficult to fabricate. More serious is the question as to where to find enough beryllium ore.

Beryllium is extracted most usually by electrolysis of a molten bath of one of its compounds, derived from beryl. Beryl is a crystalline mineral which in one form is known as emerald and in another as aquamarine. But there are forms of beryl which are not gems.

Beryl itself is not a common ore, although it is widely scattered. Gathering it is still small business and it is done usually only as the by-product of mining for other minerals. About 500 tons of ore a year are sold in the United States.

Much of the present ore is recovered as a by-product of feldspar and mica mines in New Hampshire, North Carolina and Georgia. The beryl-containing scrap heaps of these mines may contain 8 per cent. beryl, with a 2 per cent. beryllium metallic content. Most of the beryllium mining at present consists of picking out beryl crystals which puts production in about the same stage as gold mining by finding nuggets.

So scattered is beryl and so low in concentrations does it occur that the U. S. Geological Survey lists no known reserves of this ore. In a mineral sense it has some aspects of the gold-in-seawater problem; the gold is there in large quantities but in such low concentrations that it cannot profitably be extracted.

Beryllium also occurs in other minerals more common than beryl, but methods of extraction from these sources are not at hand. Despite the seeming paucity of supply, however, engineers and industrialists backing the newcomer in the family of metals are not worried. They point out that we haven't been looking for beryl very long; and they recall that Bartlett Mountain's fabulously rich content of molybdenum, which provides us with some of our finest steels via the alloy method, was long incorrectly labeled graphite.

For the man who can find and develop adequately rich deposits of beryllium there may be a fortune.

Science News Letter, June 3, 1939

The U. S. Biological Survey has a black bear skull believed the biggest on record—13¼ inches long and 8 inches wide.

●RADIO

Dr. G. W. Kenrick, radio engineer and professor of physics at the University of Puerto Rico, will be the guest scientist on "Adventures in Science" with Watson Davis, director of Science Service, over the coast to coast network of the Columbia Broadcasting System, Monday, June 12, 5:45 EDST, 4:45 EST, 3:45 CST, 2:45 MST, 1:45 PST. Listen in on your local station. Listen in each Monday.