

blocks and watched them topple as the cars lurched. Some sat at tables and tried to write, to compare the ease of writing in different cars. Some wandered through the corridors to see how hard it is to keep their balance. Others just looked at the landscape "to feel" the ride.

As important as the comfort of the passengers, is the cost of operation and maintenance of the new car. This is determined, in large measure, by the lightness which can be achieved without loss of safety. In this respect the "pendulum" car is noteworthy.

The "pendulum" car weighs 60,000 pounds as compared with about 160,000 pounds for the standard coach of today. The lightness makes possible faster stopping and starting. The good road-holding and smooth-riding qualities mean that there is no sacrifice of passenger comfort or long life of equipment. Diminished fuel and motive power requirements for light trains constitute an additional saving of weight. Braking becomes easier and the wear on wheels and tracks and roadbed is cut down.

The pendulum action and low center of gravity allow higher speed on curves. The linkage between the body and trucks is so flexible that the train could go around a curve of 180-foot radius. These considerations are especially important on short, tortuous runs through suburban areas where commuters watch every minute of schedule time.

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## CHEMISTRY

# Make Your Own Diamonds of Iron Filings and Sugar Carbon

## Graduate Students Can Produce Genuine Stones, But Have Trouble in Finding Them After They Are Done

**R**EAL diamonds made in the chemical laboratory, synthetically, were described at the meeting of the American Chemical Society in Dallas, Texas.

How many imminent bridegrooms for this year's crop of June brides thus missed an opportunity to go into the diamond-making business at the right time is unknown, but for their benefit the details should be recorded as outlined by Lewellyn D. Lloyd of the chemistry department of McPherson College, McPherson, Kansas.

Under the direction of Dr. J. Willard Hershey at McPherson synthetic diamonds have been prepared by successive groups of graduate students. Here is the simple formula for making diamonds:

Mix two parts of chemically pure iron filings with one part of pure sugar carbon, by volume. Place in a graphite crucible and heat to a temperature of at least 4,000 degrees Centigrade for a little over an hour. Then remove the crucible and plunge into a freezing solution of ice and salt brine. Treat the

hardened mass with hot aqua regia for 300 hours to dissolve the iron and digest the residue as much as possible with various acids. Finally search the remaining carbon dust for the diamonds. Use a microscope in the search, for any diamonds will be very tiny. But they will be diamonds, which is what you started out to make.

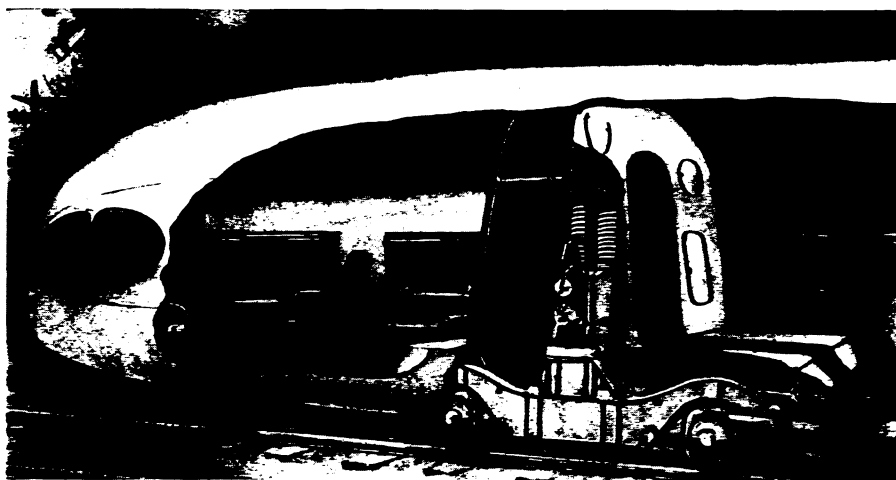
But seriously, the simple statements above have required a great amount of research to bring them about. When Dr. Hershey began the year there was no way in which temperatures of 4,000 degrees could be controlled in a fashion required in the research. And there was the problem of building a fire brick furnace that could withstand the high temperatures.

The continued research has shown, Mr. Lloyd indicated, that the formation of the diamond seems to depend on how fast is the cooling of the heated mass of iron and carbon. This cooling and the tremendous pressures which are built up inside the iron-carbon mass during cooling, seem to turn black carbon into the transparent carbon which man calls a diamond.

As white hot molten iron cools to a red solid it expands, Mr. Lloyd said. As it cools from a red solid to room temperature it contracts. Thus the outside of the iron, which cools more rapidly than the inside of the mass, is contracting while the inside is still expanding. The carbon, dissolved in the iron, is thus subjected to a pressure estimated at 180,000 pounds to the square inch.

### Dull Treasure Hunt

One of the most tedious stages, Mr. Lloyd said, is the searching for the microscopically-small diamonds after they are made. A student has recently proposed a method of mixing the final residue with potassium bisulphate which has a specific gravity between that of graphite and diamonds. Thus, the diamonds, if there are any, should sink to the bottom and the graphite float to the top. After the mass hardens it should



### SUSPENSION

*Soft springs on these towers carry the "pendulum" car which is suspended from them. Result of the novel construction, details of which are shown in this artist's drawing, is an easy-riding car that takes curves so well water will not spill out of the passenger's drinking cup. The principle of overhead suspension is adapted from monorail cars, which were never widely used because of already-existing two-rail track facilities; the new car rides on the regular tracks.*



#### GLASS LACE

*To insulate the coils of powerful electric motors, glass marbles, three-quarters of an inch in diameter are used to draw strands much finer than human blonde hair. The thread thus formed is made into gauze-like tape, fireproof and moisture proof, which is being used experimentally by Westinghouse engineers.*

only be necessary to examine the bottom portion of the mass to get the diamonds.

#### Body Pierced by Atoms

The work of scientists smashing atoms with giant disintegrating machines, or studying atoms blowing themselves apart in radioactive processes, may seem remote from everyday living, but the truth is, that man himself is just a walking sample of disintegrating atoms. Every minute over 500,000 atoms—yes, your own atoms too—are tearing themselves apart. And at each disintegration, wherever it may occur in the body, rays are sent out which pierce the tissues for a distance of about a fifth of an inch.

Before the meeting of the American Chemical Society, Dr. A. Keith Brewer of the U. S. Bureau of Chemistry and Soils, Washington, D. C., told of the amazing and vastly important role which the element potassium plays in living and in inanimate nature.

One variety of potassium, known as  $K_{40}$ , is the culprit which is disintegrating within the body at the rate of 600,000 atoms a minute for a man weighing 160 pounds. Of all the chemical elements necessary to sustain life potassium is the only one which is radioactive.

Some investigators, explained Dr. Brewer, hold that potassium's radioactivity is the cause of the heart beat and that it has a basic role in the germination of seeds. And because it liberates piercing radiation there is a suspicion that it has played a part in causing these freak offshoots in man's natural evolution. Radiation from X-ray tubes and tubes from radium, very similar in nature, have been shown to produce mutations, as these freaks are called.

#### May Cause Mutations

Thinking biologists, since the discovery of piercing cosmic radiation, have asked whether such rays might cause mutations also. Dr. Brewer has no answer to that question but he has evidence indicating that one needs to look no farther away than one's body to see a greater, possible cause of mutations. Radioactive potassium, he has found, has a 75-to-one better chance of causing a mutation than does a cosmic ray.

Back 250,000,000 years in the carboniferous geologic age, when coal was in the making, there was much more potassium. In that long past epoch of geological time, estimates Dr. Brewer, potassium had a 375-to-one chance over cosmic rays.

In disintegrating, potassium 40 can

create either of two elements, calcium or argon.  $K_{40}$ , says Dr. Brewer, is the "parent" of over 99 per cent. of all the calcium in the world today. Thus man's teeth and his bones, and those of other animals, owe this debt to the disintegrating potassium element. In fact, from the known abundance of calcium—in various forms—in the earth's crust, it is not very much wrong to say that much of the world and much of the animal life on it sprang from exploding potassium atoms.

#### Geologic Puzzle

The passage of potassium into a form of argon, Dr. Brewer states, explains a long-baffling puzzle of geologists; the presence of argon gas deep within the earth. Argon, an inert, colorless gas, is one of the constituents of the earth's atmosphere. Disintegrating potassium accounts, according to Dr. Brewer's estimates, for over 95 per cent. of all the argon over or in the earth.

Atoms of potassium, breaking up, form a most important means of checking the age of matter, Dr. Brewer points out. In fact, of all the known elements, radioactive potassium is the most important in determining the geological age of the earth.

Other radioactive "time clock" methods, he explains, deal with determinations of the amount of helium in rocks, the ratio of uranium to lead and so on. But all these methods give only a measure of the time which has elapsed since the earth's crust solidified and the minerals—as we know them today—were formed. Such estimates give the age of the earth's crust as something like 5,000,000,000 (five billion) years.

The methods using disintegrating potassium as a "time clock," do not suffer from this limitation. Dr. Brewer is able to estimate that it has taken 15,000,000,000 (15 billion) years for potassium to produce the amount of calcium in the world. Thus the age of matter is at least this long, and, naturally, considerably greater than estimates based on the age of the earth's solid crust.

Whether 15,000,000,000 years goes back to a time when the earth was part of the sun, Dr. Brewer has no way of knowing, of course.

#### America's Potash

America is now free of dependence on foreign countries for its supply of potash, valuable chemical widely used by the nation's farmers as an ingredient in fertilizers.

How a dry lake (*Turn to Page 274*)

The Government will take over all life insurance, 40 per cent.

The Government will own and operate radio broadcasting in 20 years, 50 per cent.

The United States will never become a collective state, 66 per cent.

The United States will never have a Fascist dictator, 90 per cent.

A European war is coming, 80 per cent. Nearly all say within 8 years. Germany will be the aggressor, say 60 per cent., Italy, 30 per cent., Japan, 7 per cent.

A combination of nations including England, France, and Russia, will win

the war, 98 per cent.

The Spanish war will be won by the Loyalists, 50 per cent.

Another depression is on the way, 95 per cent. Most date it between 1941 and 1950.

Nazi government will last more than 20 years, say only 17 per cent.

U. S. S. R. will last more than 20 years, say 75 per cent. Soviet will endure indefinitely, 60 per cent.

People's wishes are involved in their predictions when the matters are of intimate personal interest, Dr. Cantril observed.

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not be dependent on racial, political or theological qualifications, Dr. F. R. Moulton, permanent secretary of the American Association, has urged. He contemplates the "formulation of a set of fundamental scientific principles of an ethical nature on which unanimous agreement of the delegates can be reached" and "the formulation of the maximum number of inviolable methods of international intercourse and cooperation among scientists on which the delegates can unanimously agree."

If such a common ground were established, Dr. Moulton suggests that it can be gradually enlarged until it will form a substantial basis for the general progress of civilization.

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#### GENERAL SCIENCE

## World Organization for Science Being Planned

PLANS are being laid by the American and British Associations for the Advancement of Science for the organization of international cooperation among scientists on a wider scale than exists at present.

The secretaries of the two national organizations are exchanging notes on methods of cooperation and a conference, either of British and American representatives alone, or a larger meeting of scientific leaders from all countries interested, is tentatively scheduled for this summer.

Arising from the increasing realization in both nations that scientists are responsible in large measure for the effects of science on society, the present moves for formal cooperation originate from a resolution passed by the coun-

cil of the American Association for the Advancement of Science at its meeting last December. The stage for this action had been set by the emphasis upon "science and society" provided by the 1936 and 1937 meetings of the British Association.

The British viewpoint is that the proposed world organization essentially would be composed of national and scientific groups that uphold the democratic ideals and mechanisms of scientific freedom. The British scientific journal, "Nature," of which Sir Richard Gregory, Bart., is editor, has led in emphasizing the need of resisting the encroachments that totalitarian governments have made upon scientific methods and liberties of thought.

The invitation to cooperation should

### From Page 266

bed in a California desert, and a mine in New Mexico where men worked beneath an overlying blanket of water, have made America's potash industry possible, was described at a special symposium of the American Chemical Society.

Prior to the World War, Germany with its great potash deposits at Strassfurt, monopolized the world's potash trade. These Strassfurt deposits, formed in prehistoric times by the evaporation of sea water which then covered the spot, have an origin comparable with the dry, desert-bounded Searles Lake at Trona, California.

By drilling wells into the dry lake a strong brine is encountered which contains over 35 per cent. dissolved chemicals, said W. A. Gale, chemist of the American Potash and Chemical Corporation at Trona.

The brine is rich in the salts of potassium and sodium and the separation of the various fractions by evaporation is one of the triumphs of American chemistry. The prior work in Germany was of little use in developing the present processes. The physical difficulty of founding a town of 1,800 workers in a desert region was no small feat in itself.

The Searles Lake deposits at Trona furnished 40 per cent. of America's potash needs last year, said R. W. Mumford of the same company, another speaker on the program.

As auxiliary products the salt brine produces 40 per cent. of the world's consumption of borax and boric acid, together with substantial amounts of soda ash and salt cake.

In the California brine wells the potassium chloride is obtained only after

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ingenious evaporation processes. In the New Mexico deposits, near Carlsbad, the potassium chloride is mined in operations which, in some ways, are a race against time. The urgency arises because the potassium chloride deposits lie beneath layers of water-bearing sand and gravel. If that water enters the potash mine, the operations will be abandoned because the potassium chloride is highly soluble in water.

"Should water enter the mine through caving," said R. M. Magraw of the Potash Company of America, "the damage will be to a property that would be exhausted in any event if no effort were made towards ultimate recovery."

The Carlsbad mine is worked at the 1,000-foot level, consisting of salt and other solutions immediately above the bed. The top 400 feet consist of porous water-bearing limestones, shales and clays.

In sinking the mine shaft water was often encountered. In one case the flow was 1,000 gallons a minute, said Mr. Magraw. Ingeniously these leaks were stopped and the shaft lined with concrete to stay, permanently, the flow. Water pressures of 84 pounds to the square inch now exist behind the concrete walls.

Below all this water miners do their work, using mechanical techniques as much as possible. Large amounts of explosives are employed because of the toughness of the ore. Room and pillar mining is employed with the pillars still in place. Eventually the pillars may be "pulled," said Mr. Magraw, when the deposits have been completely exploited. But, until that time, they will remain untouched because of the danger of bringing down the overlying water-bearing deposits and hence ruining the valuable potash.

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The German government has banned the use of the inflammable gas hydrogen in Zeppelins, even for trial flights.

## ● RADIO

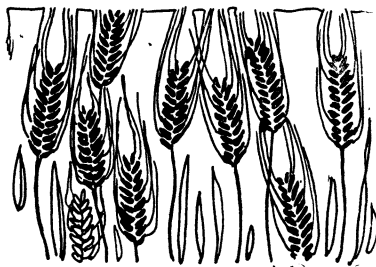
April 28, 3:00 p. m., E.S.T.

MENTAL LONGEVITY—Dr. Walter R. Miles, psychologist, Yale University.

May 5, 3:00 p. m., E.S.T.

TAMING THE WILD FLOWERS—Dr. P. L. Ricker of the U. S. Department of Agriculture.

In the Science Service series of radio discussions led by Watson Davis, Director, over the Columbia Broadcasting System.



### The Return of Malthus

**M**ALTHUS' ghost has returned to haunt us, in a new guise.

During the nineteenth century, the principles of Malthus, first set forth in his famous essay on population in 1798, were among the dominant ideas in political and social thinking. Briefly, Malthus took the gloomy view that human population always tended to increase faster than its food supply, and that misery and want and war were the inevitable consequences.

Malthus left out of consideration (for the good reason that he did not know anything about them) a number of factors that have operated at least in part to prevent realization of his pessimistic prophecy. Improvement of crop plants and food animals, invention of more efficient cultivation methods, and better means of keeping and marketing food have done much to increase the food supply. Later marriage, wider use of contraception, and possibly other factors have slowed down population increase.

But just as we are congratulating ourselves on the laying of the Malthusian ghost, up it pops again, out of the gullies of eroded and abandoned farm lands. Prof. Paul Sears, author of "Deserts on the March", expresses it as a general principle: "In the development of any civilization, the total area of cultivable land tends constantly to diminish."

Prof. Sears has pointed out the working of this principle in all the world's dead and dying cultures: Syria and Chaldea, Rome and China—and our own. Not only for necessary bread but for swollen profits, men strip the forest, pasture goats on the hills, tear the banquet-cloth from earth's table with over-eager plows. Ruin has always followed. Ruin threatens now.

Yet there is time. Just as we eased the pressure of the older Malthusianism

with better crops better cultivated, so now we can restore forests and grasslands, stop gullies, plow more sensibly. It will cost money, require more effort. But the alternative choice is decline and ultimate death.

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GEOGRAPHY—PHOTOGRAPHY

## Death Valley Sands Make Rare Camera Subject

See Front Cover

**S**AND dunes in the sunset, three hundred feet below sea level, drifting in the wind over the floor of this weirdly-beautiful Death Valley, have been caught by the camera of George A. Grant, Interior Department photographer. The photograph on the cover of this week's SCIENCE NEWS LETTER is one of a series which Mr. Grant has taken of Death Valley for the National Park Service. Others have been shown as works of art in a number of exhibitions, including the annual show of the Explorers Club.

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PALEONTOLOGY

## Fossil Jaw of Whale Found Near Washington

**T**HE FOSSIL jaw of a whalebone whale has been found near Washington, D. C., by geologists of the Catholic University of America. Somewhat broken when found, the pieces have been put together by Dr. Arthur R. Barwick, and the restored jawbone, now practically complete, is now in the University Museum.

The fossil has a total length of 118 centimeters, or a little more than four feet. As in modern whalebone whales, it has no teeth. No part of the whalebone plates once associated with it have survived: it is simply a heavy, slightly curved rod of bone.

In age it belongs to the middle period of the Age of Mammals, known as the Miocene, its antiquity estimated as about 34 million years.

*Science News Letter, April 23, 1938*

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