Galaxy
SCIENCE FICTION

FEBRUARY 1954

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BEEP By JAMES BLISH

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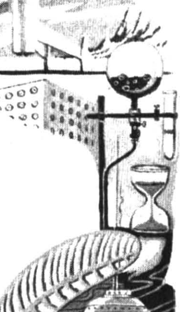
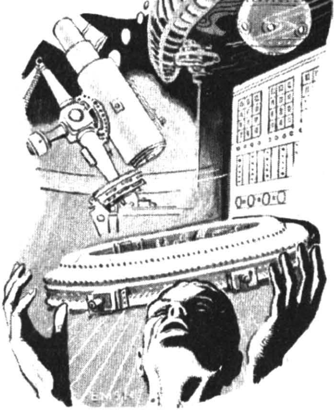


For Your Information

By WILLY LEY



HINTS TO FUTURE ARCHEOLOGISTS

LAST fall, on Martha's Vineyard island, I climbed around on a minor mystery. Atop the clay mountains of Gay Head, the westernmost point of the island, there is a tall wire fence, now open. Inside that wire fence is a nice solid concrete platform, about 15 feet by 15 feet in size and a foot or so in thickness. Underneath, in the clay ground, a kind of basement has been dug with steel posts that carry the platform. The local guide tells tourists that this was built during the first World War with the greatest amount of secrecy possible. To this day, nobody knows what purpose it served or whether it was used at all.

While standing on the platform, I thought that when the date of construction eventually is forgotten, people will be likely to explain it as a launching platform for V-2 type rockets, for it certainly resembles one. And then my mind jumped to Sprague de Camp's favorite short lecture that answers the question "How do you science fiction writers get your ideas?" and I thought that this would be a nice puzzler for a planetographer from the Rigelian star system. Five minutes later, I reconsidered. You don't have to go out into space. Just let a few centuries elapse right here on Earth and archeologists of our own kind will come across some beautiful brain-twisters, puzzles they'll never be able to solve unless still-preserved records help them.

FOR example, archeologists digging in southern England will find iron spheres. First one or two, then—having brought magnetic detectors into play—six more here, three more there, a total of about two dozen. Being careful archeologists, they will notice at once that all these spheres form a straight line, disregarding trivial lateral displacements that obviously took place later.

Their spacing is another problem, however, for it does not seem to follow any pattern.

The archeologists will then remove the spheres to the laboratory, for measurement and testing.

In size, the iron spheres are all 35.6 inches in diameter, with very minor variations. But they differ in weight. Expressed in terms of the "old" English pound, they weigh 2365 lbs., 2400 lbs., 2500 lbs., and 2990 lbs. Since even the heaviest of these is too light for a solid cast iron sphere of 35.6 inches, they must be hollow. So a couple are sliced open with great care and under remote control.

Yes, they are hollow and each opened sphere contains a little less than 500 lbs. of a crumbling powdery substance. The stuff does not explode. It does not even ignite well. It merely smolders under a sufficiently hot flame.

Throwing a sample in a beaker of water, one man finds that it separates, much of it sinking to the bottom while the smaller portion floats. What sinks to the bottom looks like sand. Chemical analysis shows that it *is* sand. The stuff that floats shows the cellular structure of wood under the microscope and is subjected to age analysis by the carbon-14 method. Analysis says the trees were cut down in 1860 A. D., with a possible error of plus or minus 15 years.

But what *are* those things? The cannon balls used in the 19th Century, the archeologists know, rarely exceeded four inches in diameter and were solid iron. And, even accepting for a moment the preposterous theory that they were projectiles, they would have been filled with a mixture of charcoal, sulfur and saltpeter, not with sand and chips of wood (uncharred) about two millimeters long and a half millimeter in thickness.

Well, the big balls actually *were* projectiles.

The long line of about two dozen of them were the test rounds fired from a single weapon, one of two super-mortars which had originally been ordered by the British Ordnance Department for the pursuit of the Crimean War. That the balls were filled with 480 lbs. of sand and sawdust was merely a proving ground safety measure. The ordnance men were testing the guns, not the projectiles.

The large mortars were the invention of a Mr. Robert Mallet, who suggested that they be mounted on barges or rafts to bombard troops ashore. The novelty was that the barrels were not cast, but consisted of a number of longitudinal bars, held together by rings and tightened by clamps and bolts.

The authorities to whom he submitted his plan did not think much of the idea, but Mr. Mallet somehow got the ear of Lord Palmerston, the First Minister of the Crown, and a tough letter written by Lord Palmerston on May 2nd, 1855, made the Lieutenant General of Ordnance take care of the matter personally.

REQUESTS for bids were sent out within 24 hours and, when a bid came in, it was accepted within 12 hours! Unfortunately the firm which had sent in the bid went bankrupt before the two mortars were finished and another firm had to take over. All this delayed the delivery period—instead of the ten weeks promised by the first firm, it took a total of 96 weeks. By then the war was over and the Chief of Ordnance asked for an accounting sheet. He did not like what he read.

The bid for the mortars had been 4000 pounds sterling for each, provided it weighed not more than 35 tons, with 140 pounds sterling for each additional ton. The two mortars weighed 40 tons apiece. The forty-odd projectiles cast by another firm cost 16 pounds sterling per ton. Two loading cranes cost 150 pounds sterling each. And the laying of just one platform for test firing was to cost 450 pounds sterling.

So it was decided to build only one platform and to test only one of the two mortars. The first test was made October 19, 1857, with a propelling charge of only ten pounds of coarse cannon powder. Range: 370 yards. The charge was doubled and the range increased to 900 yards. Round No. 7 with 70 lbs. of cannon powder carried to a distance of 2644 yards. Then something broke and had to be repaired. In December, 1857, there were more tests—one of them resulted in the first photograph of a projectile in flight—and something broke again. This went on until July, 1858, when a range of 2759 yards was reached and something else broke.

The new Chief of Ordnance, General Peel, refused to spend any more cash on this project—not a farthing more, he declared. (He did authorize an expenditure of 12 shillings and sixpence eleven years later, which was for guncotton to blast apart the piece.) As for the projectiles fired, Nos. 1, 4 and 15 were found. The engineers would have liked to dig the others up, too, but when General Peel learned that this would cost 22 pounds sterling apiece, he decided to leave them in the ground.

They are still there, at an estimated depth of 30 feet below the surface of the soil.

In the case of the big round bombs from the Mallet mortar, future archeologists might still puzzle it out — if they happen to know that the area was once an artillery proving ground. But one day they may come across several hundred yards of pipe, resting on the ocean bottom near the northern shore of Cuba. Everything about it will be puzzling, beginning with the question of what that length of pipe is doing in the ocean. This might be explained by saying that it may have been jettisoned by a freighter in distress or that it had been a tow cargo which broke loose. But for whatever reason it may have been lost, what was its intended purpose?

AFTER scraping off all the marine life which has assembled on the relic inside and out, the archeologists will find that it was not only long but also big, about five feet in diameter on the inside. The material is clearly sheet steel, but of a wall thickness that is ridiculously small compared to its size. That pipe could not have carried any pressure on the inside and it could not have withstood any pressure from the outside. But it must have been meant to carry something, and presumably something hot, because it was wrapped in heat-insulating materials.

The explanation is that this pipe once was a part of an interesting experiment conducted (and paid for) by the French physicist and inventor Georg Claude in collaboration with the engineer Paul Boucherot.

It all began some time back—to be precise, with an article in the September 17, 1881, issue of the French scientific magazine *Revue scientifique*. The article was written by Professor Jacques Arsène d'Arsonval, who later acquired fame as an electrical researcher. But this early work of his did not concern electricity. Rather, it dealt with a novel form of "steam" engine.

Professor d'Arsonval first stated for the benefit of those readers who were not engineers that any engine works on a difference in temperature levels. The steam in a boiler is "hot." The outside air, by comparison, is "cold." But it matters little what the two temperatures involved are in degrees of centigrade or Fahrenheit. What is important is that there is a difference. Nor is it necessary that this difference be as great as it usually is in a steam engine.

Take the Warm Spring of Grenelle, for example, he continued. Its waters have a temperature of 86° Fahrenheit (I am converting; actually he used centigrade, of course) and the water of a river nearby has usually a temperature of 60° Fahrenheit, often less. So there is a difference of at least 26° Fahrenheit, often more. If one immersed a boiler in the Spring of Grenelle and cooled the condenser in the river, once would have 26° Fahrenheit to work on. This wouldn't do anything if you had water in the boiler, but if you filled the boiler with sulfur dioxide, you would obtain a *pressure* difference of about 20 lbs. per square inch and this would be enough to do useful work.

Nor does one need a warm spring for this scheme, d'Arsonval added. The boiler could be in a normal "cold" river if the condenser is packed in ice. Or the boiler could be at the surface in a warm ocean and the condenser at the bottom of the same ocean, for the bottom water of all oceans has a temperature of 39-40° Fahrenheit while the surface, in the tropics, is warmed to 75-80° F.

The readers of the *Revue scientifique* probably thought this an amusing idea. They most likely checked the figures and found them correct, but they saw no reason to go on from there. Steam engines worked and one day, maybe, those who were after engines running on coal gas might succeed, too.

AT a somewhat later date, however, several engineers tried their slide rules on the problem of the extraction of energy from small temperature level differences. The first after d'Arsonval was the American William Campbell in 1913, then the two Italians Boggi and Dornig and, in 1925, the German Dr. E. Bräuer. None of them was in a position to build expensive machinery. George Claude, inventor of the neon tube and successful pioneer in other fields, was in a more favored situation.

Claude had evolved the same chain of reasoning as d'Arsonval, but doubted whether a special working fluid was really needed. Water will boil at 70° Fahrenheit, provided the atmospheric pressure is lowered.

To test his contention, Claude used two large narrow-necked glass jugs. Jug No. 1 was filled to about one-quarter of its capacity with water at a temperature of 82° Fahrenheit, the temperature of surface water in a tropical sea. From the neck of this jug, a pipe led to a small turbine in the second jug. The turbine was coupled with a tiny generator and from there wires led to three flashlight bulbs. The bottom of the second jug was covered by a layer of crushed ice, with the neck connected to an air pump. The air pump lowered the pressure in both jugs to three per cent of normal atmospheric pressure, when the valve was closed.

By that time, the warm water in jug No. 1 was boiling furiously, the turbine spun and the three bulbs burned brightly. The spent steam condensed on the crushed ice.

Heartened by this success, Paul Boucherot, the engineer of the team, spent some of Claude's money on a 50 KW generator, built a steam turbine and the necessary auxiliary equipment and assembled the whole near some blast furnaces in Belgium. The cooling water of the blast furnaces was the heat source. The river Meuse supplied the cold water for the condenser. The temperature difference was 36° Fahrenheit.

The machinery ran for the first time on April 29, 1928, and measurements proved that the auxiliary equipment (especially the air pump) used only one-quarter of the power generated.

THE next step was to run this with ocean water. After a preliminary search, the Bay of Matanzas, about 50 miles to the east of Havana, was picked.

There had to be three pipes. One to take in warm surface water. One to discharge the used water. And one was to bring cold water from the bottom to the surface.

The last pipe was the big problem. It had to be insulated so that the cold water would not absorb heat on the way up. And it had to be quite long to reach down to cold water—1.2 miles, to be exact. Since Claude wanted to use this most expensive item of the whole in a later and bigger unit, he made it quite large, five feet in diameter, although a one-foot pipe might have been large enough for the unit that had been brought from Belgium.

It was then that a streak of bad luck began. The first long pipe was lost because the ropes broke and it sank to a depth beyond accessibility by divers. The second kinked and developed a leak that could not be repaired. The third was put into place in September, 1930, but it was too short. The "cold" water came in at 58° Fahrenheit, so that the temperature difference which could and should have been 50° Fahrenheit was a mere 24° F. The equipment still ran, but it produced only a little over 40 per cent of the rated output.

Claude had to buy power from the local power company to run the auxiliary equipment!

And that is how a large and strange pipe got to be on the bottom of the ocean near the shore of Cuba.

The rest of the story does not take long to tell. Claude was advised by Dr. Bräuer and others that it had been wrong to work with low-pressure water vapor and that he should adopt d'Arsonval's proposal or use ammonia as a working fluid. But Claude blamed everything on the location on the shore and put his next set of machinery on a steamer, the 10,000 ton *Tunisie*. Again it worked badly and in the end Claude, in disgust, scuttled his equipment.

I can't report the "consensus of experts" because only a small number of men have thought about this problem to any extent. But the few whose opinion I know do not believe that Claude's failure proves that it cannot be done. They think—and said—it merely proves that it cannot be done with Claude's equipment.

ANY QUESTIONS?

A car is traveling along a road at about 30 *mph. A fly which has been sitting on a back seat rises,* *hovers in the air for a moment, flies toward the front of the car and lands on the dashboard. The fly, while hovering, was completely removed from the car, yet was not flying at 30 mph. Which scientific rule or law covers this situation?*

John Lanctot
159 Park St.
Burlington, Vt.

This is an old one and of the same kind as the following: "A fly in an empty bottle is perfectly balanced on a jeweler's scale as long as it is sitting down inside the bottle. What happens if the fly starts flying inside the bottle?" The answer is nothing for the weight of the fly stills rests on the air inside the bottle.

Similarly, in the moving car —provided it is a closed car— it is moving along at the rate of 30 mph. While the "air speed" of the fly in flying from the back seat to the dashboard may be just about three mph, its "ground speed" is 33 mph.

Could melting polar ice cause the ocean to rise enough to endanger coastal areas?

Tom Treadwell
225N. 12th
Springfield, Oregon

The answer to this question depends almost entirely on the circumstances you have in mind. I think someone calculated that if all the polar ice on both poles were melted, the oceans would rise by about 20 feet. This, of course, would endanger a number of coastal areas. But the assumptions of this calculation are that (A) *all* the ice is melted and (B) that it happens suddenly.

In reality, neither the one nor the other could take place. Nor would all the water go into the oceans directly. Much of it would enter the atmosphere and condense on high mountain chains so that the result would be longer and thicker glaciers wherever glaciers form, the inland lakes would increase in depth and size, the underground water table would be raised, and so forth.

The overall result of a gradual melting of the polar caps would likely be an increase of the depth of the oceans of only a few feet, which would be felt in a very few places.

The only portion of the spectrum visible to the human eye is the portion beginning with red and ending with violet. But it seems conceited to me to believe that these are the only colors which exist in Nature. Are there any substances colored infra-red or ultra-violet, or would it be possible to manufacture infra-red *or ultra-violet pigments? And how would such pigments appear to the naked eye?*

John Siegel
21-10, 202*nd St.*
Bayside 60, *N. Y.*

To avoid the semantic confusion which is imbedded in this question, let's begin at the beginning. Our atmosphere is especially transparent to those rays which lie between what we call red and violet. As living beings evolved, their eyes logically acquired sensitivity to the rays which were around in massive doses, though these eyes did not necessarily distinguish color. (A surprising number of highly evolved mammals are totally color blind.) As for infrared, we are sensitive to these rays, but our sensory organs interpret them as heat.

In short, then, "colors" are what we see and distinguish as colors. What is beyond the colored portion of the spectrum is still radiation that might have optical effects, like ultraviolet on a photographic plate, but only in terms of light and dark, not at all in terms of color.

Would you please explain how the gravitational pull of the Moon can cause tides on both sides of the Earth at the same time? And does the Sun cause any tides of the Earth's oceans or is it too far away?

James L. Coleman
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Toronto 9, *Ont., Canada*

The tide-raising action of the Moon is best understood if we first imagine a line drawn from the center of the Moon to the center of the Earth and then continued through the Earth.

The ocean directly under the Moon around the line is somewhat deformed, rising in the Moon's direction by about one yard. (The much higher tides observed near the shore are due to a "funneling" action of the shoreline, especially in slowly constricting spaces like the Bay of Fundy.) Then the Earth as a whole yields somewhat to the Moon's attraction, so that the ocean directly away from the Moon, where the center-connecting line touches the surface again, is "left behind," forming a second deformation that is not quite as high as the one on the Moonward side.

Because the Earth turns much more rapidly than the Moon travels around the Earth, these two bulges seem to travel around the Earth. They do not actually travel; it is simply that the ocean near that center-to-center line is deformed.

The tide-raising power of the

Sun is much less than that of the Moon, but it is measurable. When the solar bulges coincide with the lunar bulges (at "new" Moon and at full Moon), the tides are higher than normal. When a lunar bulge hits a solar "low," the tides are less than normal.

Why is it that no meteorites hit the Earth now, or hardly ever in the present time?

John Guild
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The Earth is being hit steadily by a hail of meteorites, but the vast majority of them are about the size of grains of very fine sand and burn away before they reach the surface. Really big meteorites, weighing a ton or more, are great rarities and seem to have been rare in the past, too. In the present century, there have been just two known large meteorites. Both of them struck in Siberia, the last one in 1947. But three-quarters of the Earth's surface is water and there are huge uninhabited land areas from which we wouldn't get any reports. The odds, as you can see, are against meteorite strikes in civilized territory, in case anybody happens to be worrying about it.

—WILLY LEY