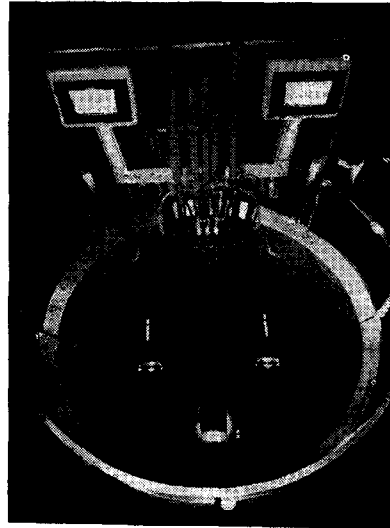




The Geneva A-furnace,
working symbol
of peaceful intent
in the Atom Age.

—Oak Ridge National Laboratory
(Union Carbide and Carbon Co.).

THE ATOM AND THE WORKINGMAN

A Candid Report on a Dimly Perceived Crisis

By JOHN LEAR

ON THE desktop before me as I write these words is a folded square of dull black paper. When I first unfold it I see nothing but the blackness, though the office is fluorescent bright and the sun's rays stream through the window at my back. I tilt the paper and peer at it. And at last in the glancing light a gleam of silvered nothing floats, as airy as a spiderweb.

But no spider wove this gossamer. Wrought by men's fingers, it is a tube of quartz pierced through the middle of its entire length with a hole too small to be observed even by the eye of a microscope.

Six inches long this fragile glass pipe was at the beginning, and a quarter of an inch across. By the time its makers were through, it was heated and stretched and wound on a drum to a total length of several hundred feet; its outer diameter was shrunk to a tenth of the thickness of the silkiest human hair.

I took this miniscule atomic siphon from the Oak Ridge National Laboratory in Tennessee, which is run by the Union Carbide and Carbon Corporation for the Atomic Energy Commission. The filmy strand was tacked to the black square for me by workers in the ORNL machine shop. They do their finer jobs under microscope lenses in order to check the accuracy of their craftsmanship to one ten-thousandth of an inch. Anywhere else

they would be known as master stylists in tools and dies. At ORNL they are classed simply as machinists.

The full scope of the difference between their magnitudes of precision and the work of most machinists will be evident only to those familiar with the skilled crafts of modern industry. But for my immediate purpose it is enough to say that the machinist and the toolmaker live in different worlds; their achievements are separated by an invisible wall of infinite pains and imagination.

The crossing of that wall is by all odds the greatest challenge of the age of peaceful atoms. Until it is accomplished, there can be no practical reality in A-power either for us at home or for others abroad who look to us for help and example. Nor will it be possible without it to bring the glowing promise of radioisotopes, like those described in the preceding pages, close to the millions who need to be healed, fed and clothed. For from the atomic nucleus we are freeing a fire that cannot be quenched at will. Once set burning, it must be watched and guarded against the smallest escaping spark. A single drop of leakage from gallons of fuel is enough to split and destroy a steel pot as tall as a man. The AEC schools for physicists, chemists, and engineers are splendid in their way. But science is thought of so much apart from life that it is forgotten how dependent scientists are on a great many people who do not consider themselves re-

lated to science. Even if some power-hungry politician should be so mad as to risk exposing the populace to unpredictable life-shortening showers of radiation from accidents due to chancy construction, atomic investment itself could not survive the losses of very many "mistakes" by workmen who build and install A-furnaces. Yet nothing even roughly approximate to the dimensions of the problem has been done anywhere to teach the workingman what he must know to cope with the atom.

The times command a renaissance of the medieval guildsman's pride, a wedding of art and science in love of creation. How can it be evoked? In some new kind of college of atomic technology? Through apprenticeships geared to the scientific laboratory?

Except for a handful of corporations under immediate contract to the AEC—Babcock and Wilcox, Westinghouse, General Electric, Foster Wheeler, Nuclear Development Corporation, Combustion Engineering, Kaiser Engineers, North American Aviation, American Machine and Foundry, ACF Industries, Electric Boat and Newport News Shipbuilding—the need is not even being discussed intelligently. Perhaps it would be more accurate to say the crisis is not perceived. Many of the subcontractors to Union Carbide at ORNL are already behind their performance specifications. Some of this is blamed on insufficient profit incentive, some on inability to enforce the

necessary conscientiousness among workers accustomed to ration the effort they exert in any given pay period. In a try at sifting the chaff from the truth, Union Carbide eighteen months ago organized a crew of inspection engineers to rove the factories of suppliers and educate both men and management to the atom's stringent demands. Even after that crew began its rounds, a "leak proof" tube in the new homogenous A-furnace (it is fueled with liquid, like an oil burner) sprang a leak because someone somewhere had used a cleaning fluid with a chloride constituent that became salt water; the whole furnace had to be torn apart and re-assembled at a cost to the taxpayers of thousands of dollars, weeks of time, and diminished prestige abroad.

A CERTAIN number of mishaps of this sort are inevitable in any development which proceeds at the speed of atomic industry's current expansion. A small shop-owner here or there will conclude that he ought to be in on a good thing, and he will bid on a contract. His bid is low, because he does not calculate into it the cost of unaccustomed precautions, but neither he nor the AEC often realizes that until the contract is let and the shortcomings appear. One way around this part of the problem is not to solicit bids on the basis of fixed specifications the implications of which may not be fully understood, but instead to ask prospective contractors to say just how they would do the job. This would maintain the competitive spirit required by the law. It was used successfully, incidentally, in letting the contract for the Army's new portable A-furnace at Fort Belvoir, Virginia.

Another urgent aspect of the problem is the looseness of materials standards in industry. Almost always compromises between what the buyer wants and what the maker considers it profitable to supply, specifications tend to be shaded on the side of the manufacturer. Only a rich and powerful buyer can enforce his demands. The AEC is rich and powerful, but what will happen when the job is taken over by industry, unless the specifications are tightened all along the line first?

So far as the strictly labor side of the problem is concerned, it could be argued that it is not entirely reasonable to choose the Oak Ridge machinists as an example of the atomic dilemma of labor in general. The exacting nature of their performance is unquestioned. Piercing sapphires with sound waves, making bearings of ceramic, drilling hairthin holes plumbline straight

through metal bars a yard long are exceptional elsewhere and commonplace to them. But much of what they do is done to give pure scientists a place to rest the engines of their minds. So let us consider welding.

All that a welder used to need was a sharp eye and one strong steady hand. He pulled two pieces of metal as close together as possible, then whisked his torch and filler rod across (a flat surface) or around (a pipe) the joint in a dazzle of sparks. Protruberance at the welded juncture was taken for granted. Little thought was given to stalactites of slag that accumulated on the underside.

Atomic welding, in contrast, requires two hands—one to hold the torch and the other the filler rod—and delicate coordination between them. The surface of the joint must have no pock nor pimple that could germinate a weakness, so the metals to be joined are first aligned to parallel exactly but not to meet, and the span between is securely tacked at three or four points before the weld proceeds. A curtain of inert gas (argon, helium, or nitrogen) is thrown around the flame of the torch and blanketed on the opposite side of the metal to screen out oxygen, which could open an unseen crevice to be attacked by corrosion or by the conspiracy of stress and pressure which uniquely typifies atomic chemistry. The metal itself is kept almost hospital-clean; it cannot be touched by the fingers. Sometimes the welder is required to work with rubber gloves inside a vacuum hood. Apprentices take three years to learn the new technique. Experienced welders are not at home with it in less than three

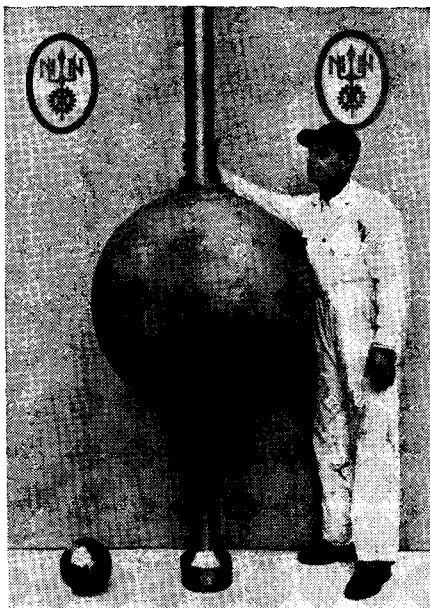
months. A skilled man spends five times as long in the making of an atomic weld as a pre-atomic. The work is rigorously inspected at every step—ORNL having six inspectors for only twenty welders. Part of the inspection is an X-ray picture.

Pipe-fitters, in an older day, were a rough and tumble lot equipped mainly with muscle. They now must read blueprints to qualify for an atomic job. They must understand instruments at least well enough to know where and how the connections lead, for flow patterns in atomic pipes are governed by remote control. The men must work with tools as high as houses to cut off valves and unscrew pipes buried deep under water for safety's sake. No smallest scrap of dirt or metal may be allowed to fall inside a pipe, lest disaster fall after. Given five to ten years previous experience, a non-atomic pipe-fitter may or may not become an atomic pipe-fitter after a year of hard work.

Painters are affected by the atom, too. At ORNL they coat inner surfaces such as A-furnace pipe with impervious plastic to turn back the constant radiation bombardment of liquids within. Outer surface coatings, on the other hand, are designed to dispose of the industrial equivalent of fallout before it can wreak serious damage to personnel. Walls are co-cooned with spiderweb-like spray which can be ripped off layer by layer in event of contamination.

ESPECIALLY in these days of do-it-yourself, it might be supposed that carpentry is too fundamental a craft to be changed. This, however, would be a most false notion. Atomic carpentry must be done to tolerances of a few thousandths of an inch. Apertures through ponderous concrete walls must be perfectly aligned, for they will carry vital instrument communication lines. Such simple constructions as the forms for concrete must be built watertight, free of knots, twice as sturdy as usual because A-furnace shields are made of double-density cement. Since wood and earth cannot be decontaminated—as metal can be—the carpenter also must be more alert than other atomic workers to radioactivity.

Undoubtedly other craftsmen will have to learn new ways to keep their places in an atomic regime, just as their forbears did with the coming of the steam engine and the electric motor. This article will serve its purpose if it tells them they cannot wait until someone shows them which way to run from bursting atoms. They must think now about the part they will play in constructively containing the atom's power.



—Oak Ridge National Laboratory
(Union Carbide and Carbon Co.)

A precision-made A-furnace firebox.

PROFESSOR OF HUMAN GEOGRAPHY

*Dr. Carl Sauer Maps People
First; Land is Mere Setting*



—ASUC.

BERKELEY, CALIF.
THE PROFESSOR leaned back in his wellworn swivel chair, took several leisurely puffs on his streamlined pipe and began talking quietly to a graduate seminar in geography.

Carl Ortwin Sauer mentioned erosion in relation to the age of Man in the New World. Ramifications led along the byways of world literature. He soliloquized for two hours on historical, sociological, anthropological topics, many far afield.

"We'll fix him," the graduate students decided. And, thinking to find a subject with which a geographer might least likely be familiar, they organized for the following seminar period a research project covering the milk industry. They divided the work, studied all facets of the subject exhaustively. For a full hour at the next session they worried the question of milk from every angle conceivable to them.

Professor Sauer sat stoically puffing at his pipe. When his proteges had run out of anything further to say on the production, distribution, and economics of milk, he casually asked if they knew the origin of dairying. They admitted they had forgotten to look into that. So, for the next sixty minutes, this campus steam engine in the guise of a phlegmatic plodder gave a disquisition on the first known dairymen and the herds they kept on the shores of the Black Sea.

Incidents like this have led Sauer students, now widely distributed through the Americas, to refer to him as "a universal mind—a Renaissance ideal of a scholar." None of them is at all surprised that he will be the fourth American to receive the Vega Medal—world's most coveted honor in the sciences of earth and sea—since its establishment in 1880 by the Swedish Society for Anthropology and Geography. They agree entirely

that he deserves a medal for his "investigations into man's utilization of the surrounding geographical milieu during various cultural epochs."

Dr. Sauer, now sixty-eight, has been chairman of the department of geography at the University of California for thirty-four years. His teaching methods are unorthodox. At Christmas recess soon after his arrival in Berkeley, he said to a half dozen students, "Let's go down across the border and see what we can see."

They piled into two cars, drove as far south into Lower California as was then possible, and sat around every evening to discuss what they had observed.

"One chap got so interested in the fog he shivered in every night," Professor Sauer recalled, "that he came back and studied and wrote an article for publication on coast fogs. We got interested in mission ruins and in Indians who were missionized. Of the six students on that trip, one became a meteorologist, one a climatologist, two developed into geographers who have made real contributions on the primitive ways of Indians, one went into physical geography and one has disappeared."

Professor Sauer came to Berkeley supposedly as a physical geographer but "human" geography displaced the strictly physical aspects of the subject. He is widely dubbed a historical geographer. He thinks geography has as much relationship to biology as anything else. He refers to himself as an "earth scientist" rather than taking a stand as either a natural or social scientist. In this role he has tilted with the anthropologists and archeologists over the age of man in the New World. He has accused American archeology of long exerting an "arrogant censorship" over proper interpretation of discoveries. He holds that man was spread widely in the New World more than 39,000 years ago.

Early this year he wrote that "the old, simple belief that man waited at the threshold of the New World until the last ice sheet was gone has been proved wrong." But he adds: "I think definitely that Old World culture is older."

Many a Berkeley scholar in fields other than geography is grateful to Professor Sauer for encouragement in following up investigations of "screwy" ideas. They call him "gentle and understanding" toward undergraduates, tough with graduate students when he feels the need to "clobber" them. Campus opinion is not all pro-Sauer, however. He is little known in many more highly publicized departments. He is called "anti-social" by some faculty and administration members. He seldom attends meetings of the Academic Senate, never takes part in "campus politics." "Actually," one of his associates said, "Sauer in a sense is better known among scholars throughout this country and Europe than he is on his own campus."

The geographer is a former president of the Association of American Geographers and holder of the Charles P. Daly Medal of the American Geographical Society. But he calls himself "an old fuddy duddy." This, he says, is especially true when he thinks about American agriculture, long one of his pet interests. A report he wrote for President Roosevelt on land use in 1934 played a substantial part in establishment of the Federal soil conservation service.

He looks askance at the migration from farms to cities. He has several farms in Missouri and Illinois and laments the growing commercialization of farms along with a reduction of animal husbandry and "the nice social life of the old days." That's one reason why he will head for Europe the day after his retirement into emeritus professorship this spring. His wife, the former Lorena Schowengerdt, and a ten-year-old granddaughter will accompany him. Behind will remain two other children of his only daughter, Elizabeth (wife of attorney Edward FitzSimmons), and one grandson, whose father Jonathan is following in the scientific footsteps of Professor Sauer. Jonathan is in botany at the University of Wisconsin.

On the European trip, Dr. Sauer will visit the Swedish Society for Anthropology and Geography. Colleagues say he was relieved at being unable to be in Stockholm on April 24 for the formal presentation of the Vega medal. For, the Berkeley men explain, if Professor Sauer were to be on hand, he would have to take a long-discarded full dress suit out of mothballs.

—LAWRENCE DAVIES.