sary if this vicious culprit was to be stopped.

Gas was the logical answer, gas that would penetrate to all parts of the plant above ground and cover all exposed surfaces. Several chemicals were tried. Some destroyed the seed beds like fire, some were ineffective. Benzol, xylol and tolulol, hydrocarbons distilled from coal, were effective.

An Accident

But an accident occurred; a seed bed upon which investigations were being conducted was destroyed. "Too much benzol gas," said one; "temperature of fumigation too high," said another. So the work was taken to the laboratory. Plants were grown in glass jars, temperatures were regulated, benzol vapor concentrations were precisely controlled and checked by gas analysis technic.

The effect of benzol on tobacco seedlings was minutely studied by scientists of Duke University and of the Virginia Agricultural Experiment Station. Working night and day, the investigators determined precisely how much benzol was required to injure seedlings.

The work was checked in the field on farm seed beds. Night after night seed beds were fumigated. Night after night gas analyses of seed bed air samples were made. Over 1000 square yards of tobacco beds in North Carolina and Virginia were fumigated. The tricks of the parasite were learned in the cold, wet nights of early spring.

Time after time, the Blue Mold was destroyed on the second night of fumigation. Time after time, the investigators started and stopped it at will.

Tin pans of all sorts littered the seed beds. Benzol was placed in them and a heavy cover of cotton sheeting was drawn over the beds to be fumigated. A little water on the cover sealed it and the gas rising from the pans was allowed to do its deadly work on the fungus during the night hours. Mechanical evaporators made of pipe, lamp wicks and tin cans were invented by farmers and engineers alike.

First Time

For the first time in man's long fight against plant disease, a method was demonstrated which would kill the parasite without harming the plants. The disease could be held in check with one-thirtieth the amount of vapor required to destroy the plants. One-sixth of the amount of gas lethal to the plants would completely destroy the fungus after the second application.

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EFFECT OF BENZOL

The seed bed at left was fumigated with benzol vapor. That on the right was not. Blue mold can be seen destroying the unfumigated plants. Separating the two beds is a board to which is attached a roll of heavy cotton sheeting.

METALLURGY

Silver Tarnish Is Prevented By Invisible Oxide Film

Colorless Layer of Beryllium or Aluminum Oxide Gives Astonishing Protection and Perhaps Longer Wear

THE dark cloud of tarnish that spreads over silver in our dwellings is about to be dissipated by a new scientific method.

A new way of preventing silver tarnishing, with promise of practical industrial application, has been developed through fundamental metallurgical research in the Cambridge University laboratories of Prof. R. S. Hutton and Dr. U. R. Evans. It consists of developing an invisible coating of beryllium or aluminum oxide over the silver—a colorless layer of the stuff of beryls or sapphires.

Drs. G. J. Thomas and L. E. Price constituted the research team. Modern science cooperated with an ancient British institution, the Worshipful Company of Goldsmiths, founded in 1320 and still the authority for the Hallmarking of sterling silver and for controlling the British coinage. This organization initiated and financed the researches.

Two successful ways of spreading the protective coating over the silver have been devised. First the oxide film was produced by a process of heat treating specially alloyed silver under special conditions. The alternate method which can be applied to old as well as new silver objects consists in electro-depositing the films upon the silver.

The hint that led to the development of the new silver protection came from recent scientific research which has indicated that most incorrodible or passive metals owe their properties to the existence of invisible protective oxide films found upon their surface. Metallurgists knew that stainless steel did not corrode and rust because of an oxide film formed of the chromium and nickel added to the iron. The Cambridge metallurgists therefore hunted for such an oxide that could be formed from some metal added to the silver. German research suggested that the protective ef-

fect of oxides was generally associated with high electrical resistivity of the oxides and this led to extensive studies of alloys of silver containing aluminum, beryllium or silicon.

Then the problem was how to get an oxide film of these metals formed before the silver itself would oxidize. The fact that sterling silver requires 92.5 per cent. silver prevented the adding of large amounts of these metals analogous to practice in stainless steel making. The greater affinity of aluminum and beryllium for oxygen came to the rescue. The trick was to give the metal just enough oxygen to satisfy the added light metals but not the silver. This was done by heat treating at about 400 degrees Centigrade in an atmosphere of pure hydrogen dried with concentrated sulfuric acid, leaving just a little water vapor, enough to allow selective oxidation of the lighter metals.

Before the film-protective methods were devised, extensive tests were made on over 100 alloys including many that had previously been thought to show promise but none of these showed any hopeful prospects. In smoky English kitchens, in rural, village and city sitting rooms, in other places where the atmosphere might be hard on silver, triplicate samples were placed for varying periods of time. The tarnish was measured by various methods, ranging from visual inspection to a precise electrochemical analysis, which dissects various constituents in the millionth of an inch tarnish film. This film was found to consist of not just silver sulfide, but also of silver sulfate, cuprous oxide, and cuprous sulfide, and the methods employed enabled these tarnish products to be quantitatively estimated.

May Resist Wear

The protective effect of these processes is astonishing so far as the prevention of tarnishing is concerned, but it is too early to speak with assurance on wear resistance, although the well known hardness and abrasion resistance of the oxides of aluminum and beryllium offer hopeful prospects.

Other metals may be protected by the selective oxidation method. The same principle has been applied to prevent the high temperature scaling of copper, an achievement that gives promise of industrial utilization.

The control of the methods by the Worshipful Company of Goldsmiths of London, a quasi-public survival of the old guild of workers in precious metals, will allow the industrial development of the new process in such a way that there will be no monopoly by any one manufacturer. The experimenters feel that their novel scientific approach to the tarnishing problem has given very promising results, but that much remains to be done to test the wear resistance and other properties of the protective films and to develop the treatment processes to simplify them for industrial application.

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PALEONTOLOGY

Human-Like Tracks in Stone Are Riddle to Scientists

They Can't Be Human Because They Are Much Too Old—But What Strange Biped Amphibian Can Have Made Them?

WHAT was it that lived 250 million years ago, and walked on its hind legs, and had feet like a man?

No, this isn't an ordinary riddle, with a pat answer waiting when you give it up.

It is a riddle of science, to which science has not yet found any answer. Not that science gives it up. Maybe the answer will be found some day, in a heap of broken and flattened fossil bones under a slab of sandstone.

But as yet all there is to see is a series of 12 foot-prints shaped strangely like those of human feet, each 9½ inches long and 6 inches wide across the widest part of the rather "sprangled-out" toes. The prints were found in a sandstone formation known to belong to the Coal Age, about 12 miles southeast of Berea, Ky., by Dr. Wilbur G. Burroughs, professor of geology at Berea College, and William Finnell.

Recently Prof. Burroughs was visited, in his laboratory by some Kentucky mountain men, who took him up into their hills and showed him another place where there were many of the footprints. This mountain site, indeed, seems to have been the "Old Kentucky Home" of a whole family of the mysterious animals, for Prof. Burroughs reports that the footprints "range in size from small ones about 4½ inches long to tracks the size I have written you about," which were nearly 10 inches in length.

Newest find of the mysterious footprints was made on a rock outcrop in a pasture near Festus, Mo., about 30 miles down river from St. Louis. Thomas L. Donnell, who found them, poured plaster of Paris into the prints to make casts. He sent the casts to Alfred Baily, director of the Colorado Museum of Natural History, who in turn forwarded them to Charles W. Gilmore, curator of paleontology of the U. S. National Museum in Washington, D. C.

Mr. Gilmore states that some tracks like these, in sandstone of the same geological age, were found several years ago, in Pennsylvania. But neither in Pennsylvania, Missouri, nor Kentucky has there ever been found even one fossil bone of a creature that might have made the tracks.

Mr. Gilmore, searching old scientific publications, discovered that similar tracks had been found on the Missouri bank of the Mississippi river long before. In the American Journal of Science for 1822 there were letters to the editor by Henry R. Schoolcraft, noted early American scientist, and Senator Thomas H. Benton, telling of "human" footprints in the rocks along the waterfront at St. Louis. Mr. Schoolcraft added that these prints even then had long been known to the original French settlers of the city.

Human Size

The footprints are exceedingly curious things. They are the right size to be human—nine or ten inches in length—and they are almost the right shape. Practically everyone who sees them thinks at first they were made by human feet and it is almost impossible to persuade some people that they were not.

If the big toes were only a little bigger, and if the little toes didn't stick out nearly at a right angle to the axis of the foot, the tracks could easily pass for those of a man. But the boldest estimate of human presence on earth is only a million years—and these tracks are 250 times that old!

The highest known forms of life in the Coal Age were amphibians, animals related to frogs and salamanders.