METALLURGY

Pilot Plants To Test Methods Of Producing Sponge Iron

Experiments of U. S. Bureau of Mines Indicate That It May Be Produced Directly From Ore by Natural Gas

TWO PILOT plants of 30 to 50 tons daily capacity are planned by the Bureau of Mines to test on a semi-commercial scale the production of sponge iron, Dr. R. R. Sayers, Director of the Bureau, has announced. Operation of these plants as well as direction of the research work will be under the supervision of Dr. R. S. Dean, assistant director of the bureau.

Past experiments of the Bureau of Mines dating back to 1927 and of others have shown the feasibility of producing sponge iron directly from the ore by the use of natural gas or of non-coking coal, cheapest of fuels. Smaller and less expensive furnaces can be used because the ore is not melted as it is in the blast furnace which produces pig iron. They could utilize small deposits of ore, deposits too small to supply a modern blast furnace.

Such plants would not displace existing industry, Dr. Sayers stated, but would supplement it by providing low-carbon iron in place of vanishing scrap to make steel for guns, tanks, ships and other war material. Ordinarily, pig iron and scrap are mixed to make steel.

Sponge iron can be produced from the ore by hot reducing gases obtained from natural gas or from coal by a "reforming" process. These gases contain carbon monoxide, deadly gas of the automobile exhaust, or hydrogen. The carbon monoxide combines with the oxygen in the ore, leaving metallic iron which collects as a spongy mass at the bottom of the furnace.

These two processes, the one using natural gas, the other coal, will be the first to be tried out on a semi-commercial scale in the Bureau's pilot plants. But other processes will be investigated also.

A side-line use for the reducing gases would be the making of high-purity soft iron free from carbon by the reduction of highly pure iron oxide. There is a high demand for this material by electrical manufacturers, particularly for magnet cores and armatures. Much of it was formerly imported from Sweden.

When the processes are proven, Dr. Sayers stated, and the Bureau's equipment developed to a commercial scale, the scrap situation in this country would be alleviated a few months thereafter.

This so-called sponge iron process is the first by which man smelted iron from its ores. The ore was intimately mixed with charcoal in a small furnace or even on a forge. Air was blown in by a bellows. The temperature reached, 1,400 to 1,500 degrees Fahrenheit, was not sufficient to melt the iron, which gathered in a spongy or powdery mass at the bottom of the furnace. These characters were due to about 50% slag. This was afterwards hammered out of the metal, which was called wrought iron. There was also much loss due to oxidation. Some improvement was made by adding a limestone flux.

All the iron and mild steel produced in ancient and medieval time up to the middle of the 14th century was produced in this way. Then the blast furnace was invented. This was nothing but a bigger furnace with a better blast operated by water power. About 1612 a further improvement was made by substituting coke for charcoal, motivated at first by the fact that England was being denuded of her forests by the voracious iron furnaces.

In the blast furnace a temperature of 2,700 degrees Fahrenheit or more is reached. This melts the iron, and the product is cast iron.

Long after the introduction of the blast furnace, however, wrought iron was still preferred to cast iron. Nowadays it does not matter what way we get our iron, for metallurgists have learned to change its character.

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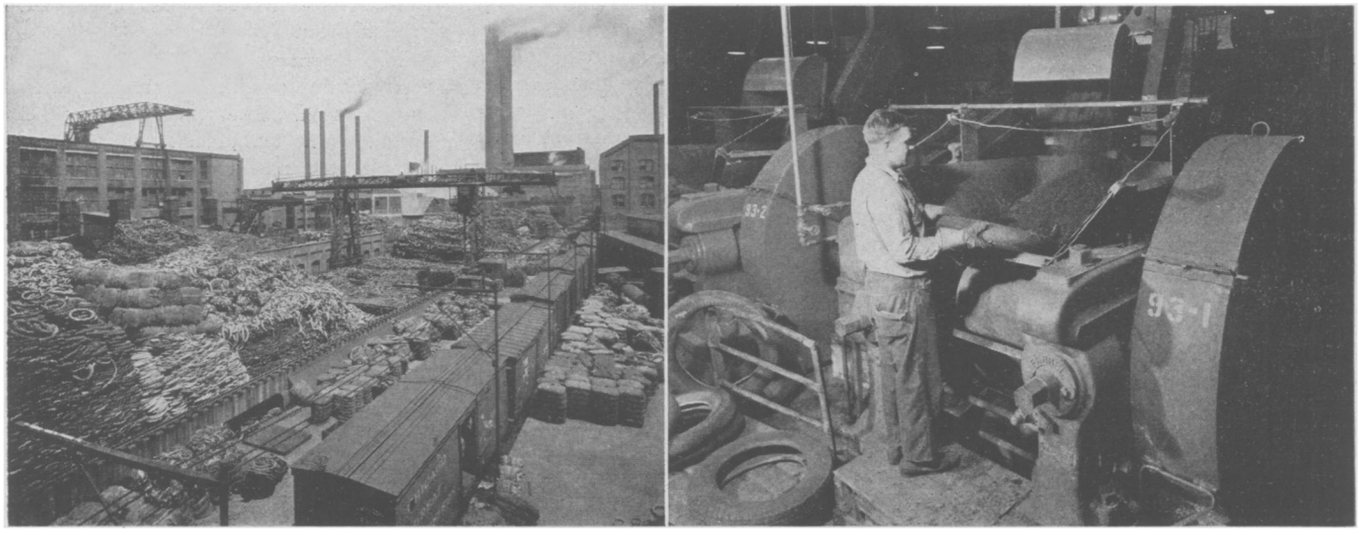
IN THE SCRAP

What happens to the old tires and overshoes you turned in to the Government is told in this story in pictures from the B. F. Goodrich Co. At the left is shown the mountains of miscellaneous scrap as sent for reclaiming. Old tires are ground up (right) and then placed in a de-vulcanizer where caustics eat the cotton from the rubber.



INVENTION

Rifle Bullets That Flash Help Marksman Correct Aim

Patent Enables Riflemen or Machine-Gunners to Have Advantage Now Exclusive with the Artillerymen

RIFLEMEN or machine-gunners in future will have an advantage now possessed only by artillerymen, who can tell where their shells fall by watching the flash or smoke of the explosion, and thus correct their aim. This improvement in small-arms fire control is expected to result from a new-type bullet on which U. S. patent 2,288,627 has just been issued to Frank Kowalski, Jr., now on service in the Army.

Small-arms bullets, the inventor points out, register their fall only when they drop on dusty ground or a relatively flat water surface. He undertakes to remedy the situation by providing hollow bullets, with metal very thin near the point, containing a smoke-making compound for daytime use, or an incendiary mixture that will make a flash at night. He states that in actual tests on the range these bullets have shown up well.

Rights in the patent are assigned to the government, without royalty payment to the inventor.

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"Squeeze-Down" Bullet

ANOTHER bullet is included among the week's crop of 742 patents. It is the invention of a German, Waldemar Born of Stuttgart, but application for the patent (No. 2,288,604) was made over a year ago, before this country became involved in the war. Herr Born's invention belongs to the class sometimes called "squeeze-down" bullets, which are intended for firing through rifle bores that diminish in caliber towards the muzzle, to secure greater powder pressure and hence higher velocity.

Around a rifle bullet of conventional type, having a little less than the caliber of the bore at the muzzle, there is a second envelope of metal, with one or more hollow bulges around its middle, of the caliber of the bore at the breech. This takes the rifling and spins the bullet, and at the same time is squeezed down to the muzzle caliber as it progresses through the bore.

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Better Gun-Casting Mold

ANOTHER invention of warlike purpose is offered by W. G. Donald of Philadelphia (also now in Army service) and J. L. Martin of Lowell, Mass., for government use without royalty. It is a mold for casting field guns, belonging to the category known as centrifugal casting molds. The mold, hung vertically, is spun rapidly after being filled with molten steel. This sets up a centrifugal force, which causes the densest and strongest part of the metal to form on the outside. The present invention improves this mold by making its suspending flanges just a trifle less than a tight fit in the suspending rotor, to allow for expansion when it is hot, and thereby to prevent the "freezing" of the mold in the rotor. The patent is No. 2,288,614.

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Television for Pilots

TELEVISION comes to the aid of the airplane pilot who cannot see what is ahead of him or the ground because of obscuring fog or haze. Use is made of infra-red or long-wave light rays which, as is well known, will get through where ordinary light will not. This light is just as invisible to the human eye as ultraviolet or short-wave light. Photographs can be made by means of it; this is frequently done by reconnaisance planes. But the pilot lost in thick weather has no time to develop a picture. In the invention of Harold A. Adams of Bakersfield, Calif., the infra-red image is formed in a television transmitter and sent by wire, instead of through the air, to the receiver on the instrument board. Thus the invisible infra-red image is converted instantly into a visible image in which all movements can also be

RE-USE FOR WAR

Reclaimed rubber is thoroughly mixed or kneaded under pressure on steam-heated mill rolls (left). Final step is shown (right) in this view of a skid load of slabs of reclaim taken from the refiner. It is now ready to be made into articles of war.