

RESTRICTED

353

FERROUS SCRAP IN STEEL PRODUCTION

22 November 1946

47-42

CONTENTS

	<u>Page</u>
SPEAKER -- Mr. Edwin C. Barringer, Executive Secretary, Institute of Scrap Iron and Steel.....	1
GENERAL DISCUSSION.....	10

THE INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

RESTRICTED

RESTRICTED

THE INDUSTRIAL COLLEGE OF THE ARMED FORCES

PUBLICATION NUMBER L47-42

RESTRICTED

FERROUS SCRAP IN STEEL PRODUCTION

22 November 1946

CAPTAIN WORTHINGTON: The speaker this morning is Mr. Edwin C. Barringer. Mr. Barringer was a student at Western Reserve University and Case School of Applied Science, Cleveland. Shortly after completing his education he entered the newspaper field, where he occupied the position of political reporter for several daily newspapers in Columbus and Cleveland, Ohio.

During the period 1917-1938 he was a writer for and editor of trade journals in the iron and steel industry, including the magazine "Steel," of which he was managing editor.

In 1938 he was appointed executive secretary of the Institute of Scrap Iron and Steel and since 1942, in addition to his duties as executive secretary, he has occupied the position of president of the Institute.

In 1945 Mr. Barringer, at the request of General Somervell, headed an overseas scrap mission which went to France, Belgium, Luxembourg, Germany, Italy, Czechoslovakia and England for the purpose of reviewing battlefield and other forms of military scrap owned by the American Army. The purpose of this mission was to make recommendations to General Somervell in respect to the disposition of such scrap accumulations which in many instances included vast stores of surplus war materiel of both American and enemy origin. Members of the committee accompanying Mr. Barringer included representatives of American ferrous and nonferrous scrap dealers and fabricators.

Mr. Barringer is recognized as one of the leading authorities in the field of ferrous and nonferrous scrap. The subject of his lecture is, "Ferrous Scrap in Steel Production." Mr. Barringer.

MR. BARRINGER: Captain Worthington and students of The Industrial College of the Armed Forces: When you read that my subject was to be Ferrous Scrap in Steel Production I wondered if you pictured me as a man with a bushy beard on a creaking wagon behind a bony horse. It would not have been surprising because with a great many people I know scrap is confused with junk and the scrap dealer is regarded as a junk man. Incidentally, among ourselves we refer to one another as junk dealers, but we do not like an outsider to do it.

I would not disparage the type of man on the wagon referred to because he was the founder of a really great industry, though he is no longer a representative of it, which has grown so far beyond the wagon

RESTRICTED

stage. It is really a great industry, the volume of purchased scrap marketed over the past few years having averaged about 20 million gross tons annually. We provide gainful employment for about 200,000 persons, including men engaged also in collecting and preparing other waste materials.

Perhaps I should explain right here that scrap is a branch of what we call the waste materials industry, which includes rags, rubber, non-ferrous metals and other waste as well as scrap iron. The dollar volume of scrap is about equal to that of all of the other waste materials combined, and when I talk about scrap this morning I am talking about iron and steel scrap. In the jargon of the industry the word "metals" is used to apply to the nonferrous metals such as lead, tin, zinc, copper, brass, etc. Before I go into the details of the collection, preparation and shipment of scrap iron I would like to lay a little background of our industry. Please note that I use the word "scrap" almost exclusively to distinguish it from salvage, which is quite another matter.

There has been a scrap industry ever since iron and steel have been known. The Bible speaks of a man called Tubal-Cain, who was an instructor of every artificer in brass and iron, and he is regarded as the founder of the scrap, as well as the iron and steel, industry. Through the years as the iron and steel industry was built up there must have been a scrap industry, albeit it was unorganized. So, this man on the wagon has a long and honorable pedigree.

There is a record that Geoffrey Chaucer, who some say is the founder of English literature, back in 1389 was appointed Clerk of the Works of the Tower of London, and one of his duties was to collect and inventory scrap metal. In 1699 the manifest of Captain Kidd's ship showed 10 tons of scrap iron in the cargo. Paul Revere not only rode a horse but he was also a worker in brass, silver, copper and just a little in scrap iron. When George Washington was President in 1793 he approved a resolution of Congress for the purchase of a chain for a frigate, and in so doing inquired whether there was not some salvage in the old chain, indicating that he had the instincts of a scrap man. In 1845 Henry Thoreau, who wrote "Walden," was sitting at the end of his pond just outside of Concord, and along which ran what is now the Boston and Maine Railroad. In his "Walden," written in 1845, a hundred years ago, he tells how he noted in freight trains that went by "scrap iron, junk and old nails," to use his words. So you see we have a very long and honorable pedigree, notwithstanding the horse and wagon.

The first iron to be cast in this country, so far as we can determine, was done by a man named Jenks, just outside of Lynn, Massachusetts, in 1649. He cast a small iron pot of about two-quart capacity for a descendant of Hendrik Hudson, the explorer. This pot is still in existence in the library at Lynn, minus one leg; it is remarkable that some object of iron has been in this country almost 300 years and no scrap dealer has laid hands on it.

RESTRICTED

During early colonial days the manufacture of iron expanded rapidly. We were also heavily importing iron from England. All this time scrap was building up but the organized scrap industry as we know it today dates back to the late 1840's--a time when there was a great exodus of persons from eastern European countries for social and economic reasons. These immigrants arrived mostly in New York--although a few also came to Philadelphia; they were desperately poor; they were fitted out as peddlers and roamed the eastern part of the United States selling pots, pans and kettles to housewives. Eventually when they built up a little capital they acquired horses and wagons. They resold their accumulation of scrapped farm implements, bones, rags and other waste materials to the depots in the cities that fitted them out as peddlers; these depots may be considered to have been the first scrap yards.

The ferrous metal industry in the United States started out making cast iron, eventually developed wrought iron, and eventually matured into Bessemer steel. The processes for making these metals were scrap-producing but not scrap-consuming. In the meantime, the supply of scrap, both visible and invisible, was building up. It was to take advantage of this large potential of scrap that the open-hearth steel furnace was principally developed. Incidentally, there is some reason for believing that the acute shortage of scrap which first became apparent in 1942 was a result of the gradual exhaustion of this potential of scrap, because since the output of open-hearth steel overtook that of Bessemer steel in 1908 more scrap has been consumed than generated in the United States.

By the way, in a sense there never can be an actual shortage of scrap because everything of iron and steel is potential scrap. Statisticians have figured that if you take all the iron and steel ever produced in this country, add imports, subtract exports, subtract material lost through corrosion or sunk at sea, you would come up with a figure of about 1.6 billion gross tons of iron and steel in use in the United States today in every form, from pins to locomotives. The cast iron in the dome of the Capitol in Washington may be there for five hundred years, but eventually the scrap man will get it. Steel that goes into food cans may return as scrap within a month. Some small objects like dental burrs may be discarded in the dentist's waste basket. A razor blade may be dropped down the slot of a Pullman washroom, or an automobile may be abandoned in the desert. Except for these comparatively minor losses, whether it be for a shorter or a longer time, everything is grist for the scrap dealer's mill, and if the price is high enough he will tear down the Empire State Building to get the scrap.

That is one reason for the saying "steel never dies." No matter how old, or rusty, or bent an object of iron and steel may be, it can be used provided it can be collected in economic quantities. Obviously, the heavier grades of scrap are preferred to the lighter ones and so-called carbon steels are preferred to the alloys, but they all have their use if properly prepared.

Before we go into the sources of scrap let me refer briefly to the manner in which scrap is used.

Scrap is a complementary raw material to pig iron. It is charged into various types of foundry and steel mill furnaces along with pig iron. As the scrap and pig iron melt they mingle and brand new steel results.

Incidentally, there is an analogy between old theology and the use of scrap. The belief is that as humans grow old they become what we might term human scrap, eventually passing on to another existence. In this existence, so the belief goes, humans are subjected to a great deal of heat which eliminates the errors of their previous existence and makes them ready for a new one. This is very similar to the melting of ferrous scrap, which is refined and purified by heat, and made ready for a new existence. So the scrap dealer may be said to do a job of reincarnation as well as conservation.

Scrap and pig iron are interchangeable raw materials. Steel may be made from 100 percent scrap, or 100 percent pig iron, or any combination of the two, although the larger the proportion of scrap the better the quality and also the lower the price of steel. Open-hearth furnaces, in which are made the common run of carbon steels, usually charge about 50 percent scrap and 50 percent pig iron. In the electric furnace, which makes high-grade alloy and stainless steel, the charge is 99 percent scrap and only one percent pig iron. The average iron foundry charges about 65 percent scrap and 35 percent pig iron. By industries, steel mills consume 75 percent of all scrap, iron foundries 20 percent, and miscellaneous users the remaining 5 percent.

In only one year (1940) since the Government began compiling statistics has the use of pig iron exceeded that of scrap. In 1945, latest full year for which Bureau of Mines statistics are available, the melt of pig iron was 47.4 million gross tons, and of scrap 50.2 million gross tons. Hence we in the scrap industry can truly say that everything of iron and steel is one-half scrap.

Particularly I would like to demolish the misconception that scrap is used to make special products, usually inferior ones. The world over, scrap is used as a complementary raw material to pig iron and in many respects it is a superior raw material because it already has been refined. As a matter of fact, as previously stated, the very highest grades of alloy steel are made in the electric furnace, which is almost exclusively charged with scrap.

Thus far we have talked about scrap without qualifying that word. About half of the scrap that is used is home scrap--not originating in homes as the name might indicate but as a by-product of the various steel mill and iron foundry processes. When hot steel from a furnace is cast

RESTRICTED

356

into a mold to make ingots, the impurities tend to rise to the top center, so the first act in making steel is to crop or cut off the top 15 to 20 percent of the ingot. This is home scrap. In the various rolling mill processes some waste results. In iron foundries there also is some waste in the various casting processes. With rare exception, this material is consumed on the premises and is called home scrap and accounts for about one-half of all the total consumption of scrap. Incidentally, the excessive use of home scrap tends to become injurious because it perpetuates the impurities in the steel. This is very much like inbreeding in families. It used to be said that a royal house was benefited occasionally by introducing the blood of a peasant girl into the line. Purchased scrap does very much the same job for the blood stream of steel mills and iron foundries.

From now on we are talking about purchased scrap; dealer scrap; outside scrap; revert scrap; open-market scrap--all synonymous.

To break down the sources of purchased scrap, we will take the figures for 1944, which happens to be the last complete year for which the Bureau of Mines has made a detailed analysis. In 1944 the consumption of purchased scrap was 20.7 million gross tons, and we are going to trace this to its lair. The largest identifiable source of purchased scrap is the metal-working factory. All iron and steel products are oversize on leaving the steel mill or foundry. In other words, when an automobile body manufacturer buys steel sheets he must have sheets that are a little oversize for the fabricating process, and the waste that is trimmed off is industrial or factory scrap. Curiously enough, sometimes steel is purposely ordered oversize so that from the scrap that results small pieces will be available for making other products. In normal times about 12 to 15 percent of the total weight of steel as shipped from the mill is wasted in the various machining or fabricating processes. In wartime, this percentage rises to 18 or 20. In making shells, for example, about 33 percent of the original steel winds up as scrap, while in making certain types of antiaircraft guns the loss is as high as 85 percent.

A few of the larger metal-working plants, principally those in the automobile and parts industries, have enough production of scrap to warrant their preparing and shipping it directly back to steel mills for remelting, but the great bulk of factory scrap goes to dealers' yards for the various processes of preparation, which I will describe later. In 1944 this factory waste, which is industrial or factory scrap, amounted to 8.4 million gross tons, or about 40 percent of the total consumption of purchased scrap.

The next largest identifiable source of scrap is the railroads, which in 1944 generated about 3.25 million gross tons. Over the years, the railroads will market about 3 million tons of scrap annually. There

RESTRICTED

RESTRICTED

are no better scrappers than the railroads, but they are careful first to sort out material that can be repaired or machined or otherwise repaired to restore it to service. A large railroad like the Pennsylvania will ordinarily sell 25,000 tons of scrap monthly. The principal railroads issue monthly lists upon which our dealers bid. The Pennsylvania, by the way, is careful to shovel up the rust that falls off freight cars and locomotives as they are being scrapped, and usually every month offers 300 to 400 tons of rust along with its scrap. So it can be said that the railroads go the packing houses one better—they utilize even the squeal.

No steel product is more useful than the rail. After fifteen to twenty years of service in main and secondary tracks a rail is relegated to a siding, in which it may be another twenty years. But eventually all rails come to market, and many are purchased for rerolling. The rerolling mills cut off the battered ends, heat the rails, slit them into three sections, and reroll them into small angles, channels, fence posts and other useful objects. Chances are that the mattress of your bed rests on steel angles which once were railroad rails.

Subtracting industrial scrap and railroad scrap from total consumption in 1944 leaves about 9.1 million tons in the broad category of what we call dealer scrap, which arises in a variety of sources. Except that it is believed automobile graveyards on the average yield about one million tons of scrap, it is difficult to divide this large total of dealer scrap into tonnages arising from city dumps, shipbreaking, building demolition, farm collections, etc. But let us explore the major sources of dealer scrap.

Foremost is the automobile graveyard. What a beating the scrap industry has taken on account of the graveyard! During the war when salvage drives were being prosecuted people said, "Look at the thousands of tons of scrap in these automobile graveyards." The fact is, the automobile graveyard is not a scrap yard but a feeder to our yards. The economic reason for a graveyard's existence is its source as parts. I like to call these graveyards the poor man's garage. Usually, an automobile graveyard operator puts a car down on his lot for the sale of parts. Prior to the hiatus in automobile manufacturing on account of the war, it was said that there was a demand for parts from a car for the first ten years of its life. After that it normally had value only as scrap, and was scrapped when labor was plentiful and the scrap market high. During the war period up to the middle of 1943 the War Production Board required graveyards to scrap their cars on a sixty-day turnover basis; after that time parts to keep cars and trucks on the road became more important than scrap for melting, and graveyard operators were prohibited from doing any scrapping.

We think of an automobile graveyard as an iron mine above ground. The normal population of these graveyards is from one million to three million cars, and each car averages from one to one and one-fourth net

RESTRICTED

tens of scrap, hence these graveyards are a source from which a substantial tonnage of scrap can be drawn immediately.

Another source of scrap is shipbreaking, but this is a long-pull affair. There are only three large-scale old-line shipbreakers in this country—two in Baltimore and one in Philadelphia, although there are many small shipbreakers who are constantly cutting up one ship at a time. The normal capacity of the old-line shipbreakers is about 15,000 tons of scrap a month. The shipbreaking program inaugurated by the Civilian Production Administration was expected to triple this rate by the first of January 1946. When World War II broke, the old-line shipbreakers were still at work on German liners seized at the beginning of World War I. Shipbreaking is a hazardous business. The largest company in the field requires about four ships a month to keep going.

Demolition of buildings is another source of scrap and also is hazardous. Out of five average jobs, a dealer will break even on three, lose money on the fourth, and make money on the fifth. As an example of the hazard, one wrecker assumed too much in bidding on one of the elevated railways in New York. To his great financial distress he found that about one and one-half miles of columns were filled with concrete, which cost more to take down and dump than he made money on the remainder of the line. Demolition jobs usually develop a substantial volume of salvage in the way of piping, boilers, fixtures—anything that can be resold.

Farms are a large source of scrap, chiefly cast. There are six million farms in the United States and it was estimated recently that there is an average of 600 pounds of scrap per farm, or a total of two million net tons, notwithstanding wartime drives. Some collectors have established beats in the countryside which they work once or twice a year. Many farmers bring in a load of scrap in the spring, when they come to town for fertilizer, and again in the fall, when they come to town for their winter's coal. Farmers are price conscious and the low prices established by OPA were not an inducement.

The small collector, who is so important a factor, early became a wartime casualty. Draft boards did not recognize his importance, and ration boards restricted him on tires, trucks, gasoline, etc. When OPA established ceiling prices that were one-third lower than any in World War I, most collectors abandoned their routes and went into munitions plants. The million or more tons of scrap which collectors garner in a year is not large compared with the monthly requirement of nearly two million tons but represents the margin of safety.

Thus to scrap yards flows a steady stream of material—mostly unprepared—from factories, railroads, farms, shipbreakers, collectors, demolition jobs and other sources. This scrap is far from being ready for use at steel mills and foundries. The Department of Commerce recognizes

RESTRICTED

seventy-five separate grades of iron and steel scrap alone. The OPA established ceiling prices on thirty-six principal grades. Dealers must separate steel scrap from cast scrap from alloy scrap from malleable scrap from stainless scrap, and prepare each grade to a physical size for the most economical charging into steel mill furnaces and foundry cupolas. The bellwether grade is No. 1 heavy melting steel which may be no more than 5 feet long and 18 inches wide and at least one-fourth inch thick. Cast iron must be in pieces of about 125 pounds. So a scrap yard is a manufacturing establishment equipped with enormous alligator shears, baling presses, oxyacetylene torches, cast iron drops, magnets, cranes and other equipment. A scrap yard is far from a disorderly place of business behind a board fence; it is a highly mechanized manufacturing establishment.

One of the most interesting operations is that of baling or bundling. In the past twenty years more new steel has been consumed in the manufacture of consumer goods like automobiles, stoves, refrigerators, household equipment, etc., than in capital goods like bridges, buildings, or railroad equipment. The lifetime of consumer goods is shorter than of capital goods and the resulting scrap is lighter in character. If an automobile fender were charged loose into a steel furnace the intense heat would burn it up in much the same manner that a newspaper, when tossed into a residence furnace, curls up and is sucked up the chimney. Today such light iron as fenders, bodies, containers, etc., is charged into a hydraulic bundling machine and compressed into a dense package about the size of an orange crate. This package or bundle melts slowly and the metal is recovered.

At the peak of the war the consumption of purchased scrap, largely supplied by dealers, was averaging close to two million tons per month. From Pearl Harbor to VJ-day the total consumption of purchased scrap was about 90 million gross tons. A blast furnace that will smelt iron ore into pig iron at a daily rate of about 1,200 tons costs 13 million dollars. It would have required 70 more blast furnaces, costing over 900 million dollars, to make the metallics equivalent to those supplied by scrap dealers. This investment did not include the additional outlay that would be required for mining and transporting the additional raw materials. The investment would also have constituted an unbearable burden of overhead after the war. The supply of scrap can be turned on or off like a spigot of water, and is the most flexible source of metallics.

Reference has already been made to the shortage of scrap that developed during the recent war. Although it is true that the potential supply had been declining over a period of years, yet actually there need not have been any shortage whatever had the scrap industry been permitted to function effectively. In World War I the ceiling price on the steel-making grade of scrap was thirty dollars. During World War II the same grade was priced at twenty dollars notwithstanding greatly increased

RESTRICTED

labor costs, social security taxes, and other factors. This comparatively low price put scrap dealers in a strait jacket. They could not reach out for remote scrap nor get out the so-called hard scrap as contrasted with that readily at hand. The OPA consistently refused to increase ceilings, with the result that reserves of scrap dwindled constantly and at one time thirty-five open-hearth furnaces were reported to be out of operation for a lack of scrap. If the money that was spent on salvage drives had been granted in the form of higher ceilings it is my belief the situation would have been improved. Inasmuch as the Government was the principal buyer of steel during the war it would have made little difference whether it had paid steel mills more for their steel than to have expended the money in financing salvage drives.

I have not referred thus far to one of the most important functions of the scrap dealer--that of conservation of natural resources. A ton of scrap is at least equal if not superior to a ton of pig iron. To make a ton of pig iron requires two tons of iron ore and two tons of coal, limestone and other raw materials. In addition, more transportation is involved in making a ton of pig iron than in generating a ton of scrap. Never can a ton of iron ore that is mined be replaced, but scrap is a crop that grows each year through obsolescence and the wastage of industry. It was a good thing for this country that it already had in being a well organized scrap industry. In another war much more attention should be paid to fostering the scrap industry and permitting it to function.

I have referred up to this point only to scrap dealers who actively collect, prepare and ship scrap. We also have brokers who largely take orders from consumers and distribute them among dealers. These brokers are the wholesalers of our industry and to a great extent finance it. In normal times brokers take orders from consumers and try to fill them at a profit. In wartime brokers are placed upon a commission basis, which greatly reduces their effectiveness. The tight scrap situation during World War II would have been measurably relieved had there been a greater awareness of the job of the broker as well as of the dealer.

My remarks have been largely based upon the handling of the carbon grades of scrap. The alloy grades are a specialty requiring separate treatment. Nickel, chrome, manganese and other alloying elements are invaluable in their place but poisonous in carbon steel, because they tend to make hard spots in steel and to reduce the weldability of steel. Because manufacturers of alloy steels themselves were loath to use scrap generated from the machining of their own products, much alloy steel scrap had to be consumed in blast furnaces during the recent war, with a consequent serious loss up the flue of manganese, chromium, nickel and other alloys.

As the spokesman for the ferrous scrap industry it is understandable that I should be considered biased, but I have a deep feeling that the

RESTRICTED

national economy requires greater attention to the problems of the scrap industry. The capacity of the country to make pig iron, which of course is a raw material for making steel, is strictly limited to physical plant, which cannot be expanded except at the cost of many millions of dollars and months of time. But almost overnight, with proper handling, the scrap industry can be so energized that the supply of scrap can be very measurably increased. There should be no repetition of the unintelligent handling of the scrap industry by young men in any future OPA who have not the slightest concept of our industry and whose attitude is punitive. It is noteworthy that within twenty-four hours after scrap was decontrolled steel mills voluntarily granted to scrap dealers precisely the advance in price they had been requesting for months previously, as a means of broadening the supply.

Gentlemen, it has been a pleasure to address you. I could go indefinitely on into the various phases of our industry. I was a newspaper man for two years before I went to the Scrap Institute. I do not know of any more colorful field or industry than scrap. I do not know what your program is, but if there are any questions you want me to answer I will be delighted to do so, remembering that I am not a metallurgist, but more of a market and practical man.

CAPTAIN WORTHINGTON: We have time for a few questions now.

A STUDENT OFFICER: I would like to ask Mr. Barringer if there is any battlefield scrap being brought back to the United States.

MR. BARRINGER: Categorically, the answer is "very little." As I recall it, after we got into North Africa we began to return some scrap from that field of operations, although I believe the British took back with them the great bulk of the scrap from that theater. We brought back some scrap from Italy and a little from the Pacific Islands, but I would say that since the war began we have brought back not to exceed 450,000 tons of scrap, which is a lot of scrap, but each month of the war we consumed about 1.8 million tons of scrap. General Somervell received a recommendation that all the heavy scrap from Germany, Belgium, France and Italy be returned. Right now there is a good deal of attention being given to the return of scrap from the Pacific Islands. There are about 100,000 tons at Pearl Harbor that could be moved if the dealers could get the cranes and trucks to move it. I imagine the overseas scrap is not much in comparison with our production requirements, but all of it would help.

A STUDENT OFFICER: The military services are encouraged, or I might say forced, to sell surplus material to scrap dealers. Can you give the economics of that, the dealer's spread when it comes off the shelf?

MR. BARRINGER: The handling of surplus is quite another business from scrap. Where scrap dealers have engaged in the sale of surplus

RESTRICTED

RESTRICTED

359

it has largely been due to their inability to make out on scrap. Since the middle of 1943 we believe there has been no profit in iron and steel scrap itself. The margin of the dealer on scrap has been negligible. Does that answer your question?

A STUDENT OFFICER: Except the percentage the dealers mark up.

MR. BARRINGER: The dealer literally has no markup. Up to the tenth of November, for example, the shipping point price of scrap in Washington, D.C., was the ceiling of \$18.75 per gross ton for prepared No. 1 heavy melting steel at Baltimore, minus the freight of about \$2. The dealer in Washington thus got about \$16.75, in round figures, for his prepared steel scrap, loaded. OPA estimated that it cost about \$3.50 per ton to prepare scrap. Actually, the cost might be as high as \$8 or \$9. When you subtract the cost of preparation from the f.o.b. car price you arrive at the figure the dealer can pay to collectors. There is no standard markup in scrap.

CAPTAIN WORTHINGTON: Thank you, Mr. Barringer, for a most informative talk.

(14 July 1947--450)S.

RESTRICTED