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THE IRON AND STEEL INDUSTRY

by

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Colonel Miles, Gentlemen.

I am not sure about the importance of my being here I am quite sure, however, about the pleasure of being with you. I have been here before as some of you may know, and enjoyed it so well that I began to get worried the latter part of the Summer because I hadn't heard about any possibility of coming down this Autumn to talk to you. But then a letter from Colonel Miles relieved my anxiety.

I am really, however, a bit disappointed in getting here now and finding myself in an atmosphere which, according to newspaper comments at least, is as unsatisfactory, as the atmosphere in which I customarily work. You all know, of course, from reading the daily papers, about the deplorable state of the steel industry, its various shortcomings and inadequacies and incompetencies and so on, but I had the impression that over the last two or three years we had been doing a good job in getting the Army onto a right basis. This is at least my third trip, I don't know but my fourth trip, down here, and I had been congratulating myself on the fact that we were building up a pretty highly educated and intelligent group of men to run our military organization, but I understand from reading the newspapers now that we don't have any real military organization, that we couldn't do a job if we had to, and that we have got to start from the beginning now and build all new. Well, maybe its a good idea to be in at the beginning and help to build, so we will, perhaps, date the origin of an efficient military organization in the United States from this morning.

I have taken the liberty of imposing upon you some mimeographed sheets that are clipped together for convenience in handling, which, on examination, you will see consist of statistical tables. I have put down there a variety of statistical data which you may want for reference to illustrate some of the things I am going to talk about this morning and perhaps to give you a measuring stick relative to certain aspects of the iron and steel industry as you will come to think about it later in other connections. By giving them to you in the mimeographed form I can keep as much as possible of statistics and other dry material out of the comments that we want to run over in our discussion. I picked out, in making up those tables, the data for certain representative years, as you will note, covering a period of approximately four decades. Some of the tables start in one place and some start in another, but in the main they cover the period since about 1900

and may be said to span approximately the lifetime of the modern steel industry. I don't know exactly when the modern steel industry began, but it was somewhere around 1900. I have added to the statistical data, as you will note, a somewhat scholastic looking map, which we had made some time ago to answer a very general request for information as to the distribution of the raw material reserves which are important to the iron and steel industry, and the locations of the producing points for making pig iron and making steel. You will find certain of the data on one side of the map and the other data showing geographical distribution on the other side of the map.

I want to divide the discussion this morning into two pieces. I am going to talk to you about certain aspects of the iron and steel industry for a time and then I would like to devote the rest of the period that you customarily spend here to an opportunity for you to ask any questions which may not have been answered by what I have said previously, and give us an opportunity to bring out in that sort of informal discussion some of the things which may have been in your mind which I could not foresee. That does not mean, however, that if, as I am going along, anyone of you has a question that is so hot at the moment that you would like to ask it right then and there, that you may not interrupt me. It will not disturb me in the slightest degree if you interrupt me anywhere and as often as you wish, except, if you interrupt me in the middle of a sentence I may not remember how I was going to finish that sentence. I do not have the facility of an illustrious scientist in one of our universities, whom I happened to know many years ago, who was dictating a memorandum to his secretary and was called to answer an urgent long distance telephonic call. He was gone something like thirty minutes. He had been in the middle of a sentence when he was interrupted. He came back and sat down and said "Comme", and went on. Now, if you interrupt me in the middle of a sentence I can't do that, but the probability is that you will not have lost much if you cut off the tail end of almost any sentence.

Now, to give you an idea of what the skeleton is of what I want to say to you this morning, I am going to say something about the raw materials of the steel industry, because there are certain problems that are presented on the raw material side, then I am going to have a few words to say about the question of pig iron and scrap, which are the first forms in which the metal supplies of the iron and steel industry are handled and some of you may have heard the term "scrap" used around here in the course of the last year or so. There has been a good deal of comment on that subject from different directions. Third, the question of steel production and the products of the steel industry from several different angles, in each of which there are certain

significant trends, and in connection with which there are inevitably some problems. Then a few words about labor and employment in the steel industry; the matter of demand for steel products and the prices of steel products; and, finally, a word or two about capital and profit, leaving the biggest problem of all until the last because there isn't any answer to that.

Beginning with the first of those points that I mentioned, as you will know, the raw materials for the iron and steel industry are relatively limited in number. Essentially, we may say there is a group of three or four raw materials on which any steel industry must be based. ore, fuel, stone, and manganese, and, perhaps, scrap. Those are the essential raw materials. Then there is a group of materials that may be called the alloy materials, a long list of them. A number of them I have enumerated on the last page of the sheets that I gave you, showing the approximate consumption in the United States and the sources of supplies from which we draw what is required. Among those the principal and the items of chief interest are nickel, chromium, molybdenum, tungsten, and vanadium. That doesn't mean that the others are inconsequential, but they are not so prominent in their application and in their significance as these five that I have specifically named. Then there is a third group of raw materials which we may call the coating materials, in which we find zinc, tin, and lead. Now there are many other materials used in the iron and steel industry, but those give you a framework for the production and processing or finishing of the main classes of iron and steel which we require.

There are two trends in respect to those materials which probably we ought to note as we go along. The first of these trends is a lengthening of the list of materials used by the steel industry. In other words, it is becoming a more complex industry in terms of the variety of materials which it uses to make its products. I could illustrate that, perhaps, most simply by a comparatively recent illustration. Aluminum is now being used as a material in the steel industry because it has been discovered that the addition of aluminum to the molten metal in the course of manufacture helps certain processes that are desirable in giving qualities to steel which are sought for in the finished product. So that, where a few years ago we used to consider that aluminum to a degree was a possible competitor of iron and steel, we now find aluminum as a fairly well recognized and increasingly important material for use in the iron and steel industry. The second trend that I wanted to note is the increasing use of the alloying materials. The list of alloying materials is being added to constantly.

No the principal problem that grows out of those trends is the question of supplies. Of the essential materials for manufacturing iron and steel which I enumerated--ore, fuel, stone, and scrap--there is an adequate supply under all ordinary conditions in the United States. On the one material, manganese, there is a difference of opinion and that difference of opinion is sharply demarked between the steel producers on the one hand and the owners or promoters, or the individuals who would like to be owners or promoters, of domestic supplies of manganese ore. The people in the steel industry maintain that there are no adequate reserves of commercial quality of manganese to be had from United States sources. The owners of alleged manganese ore deposits insist that if they were only given adequate tariff protection against the competition of foreign supplies of manganese ore or ferromanganese, they could satisfy all the needs of the industry. The merits of that controversy, perhaps, would make a good special topic for some of you to study and on which to report to Colonel Miles. The Bureau of Mines here in the Department of the Interior has some very extensive and interesting information on the subject of domestic supplies of manganese.

In the alloying group, we have no nickel that is worth talking about, little or no chromium, hardly any vanadium. We have tungsten at a price, I think it is probably true that at a price we could satisfy all our needs for tungsten, although under ordinary conditions of affairs in the Far East, the possibility of competition from Chinese tungsten ores was so keen that domestic production of tungsten was relatively unimportant. In any emergency, however, there probably are adequate sources of tungsten in the United States.

In molybdenum we are dealing with a relatively new and not yet completely known factor in the alloying of steel. I say new in spite of the fact that molybdenum was one of the essential materials in the list of the War Department in the period from 1917 to 1919. Interestingly, however, only then required in small quantities. Today molybdenum is being produced in increasing quantities, is being consumed in increasing quantities, and almost every year is being demonstrated as capable of doing something which it had not previously done for the iron and steel industry.

Thus, the problem of alloying materials with reference to foreign supplies is in a state of flux, influenced to a very considerable extent by the still unmeasured possibilities in the adaptation of molybdenum. Molybdenum has been substituted in place of tungsten in high speed steel with a good deal of success. It works out with chromium or nickel in small quantities

to produce a fair grade, if not an acceptable grade, of corrosion resisting steel, and it does a number of other things. One of its newest uses is in giving an increased tensile strength to gray iron casting which is opening up a considerable vista. I am told, for example, that the introduction of the proper per cent of molybdenum in gray iron castings, may give a tensile strength of 50,000 to 60,000, which is getting comparatively close to the tensile strength of a common steel.

In the casting products, zinc, lead and tin, there is an increasing dependence in application on tin and no supply available in this country, so that to a considerable extent the trend of production in the steel industry of more complicated steels involves an increasing dependence on imported sources of supply for some of the raw materials. Whether it would be wise or unwise to try to build stocks of those materials against emergency requirement is a very large question. There are adherents, some of them very vocal, on both sides of the question. It is largely a problem of military or strategic significance as to whether that should or should not be done. It may come to some of you to decide that question at some time in the future.

Now our second question--pig iron and scrap--the forms in which we deal with the supplies of metal out of which to make steel. There has been a very definite tendency for a good many years to ward less pig iron and to ward more scrap as the source of metal that goes into the steel furnace. If you look at the second page of the tables that I gave you, at the second table on that page, you will find in the right hand column, I believe, a figure representing the percentage relationship between the use of pig iron and the production of steel. You will note that forty years ago upwards of ninety per cent of steel found its source of metal in pig iron and over the ensuing period the percentage has declined until in recent years, except for 1937, the figure has been in the lower fiftys or perhaps an average of about 55 per cent.

That trend in the practices of making steel has elevated scrap to a place of first importance in the operation of steel-making furnaces and interestingly enough, and I'd like to have you make particular note of this fact, there are very few of the steel producers that are in any position whatsoever to exercise any degree of control over their supplies of scrap. All the pig producers of steel are fully integrated as we say, from the ownership of ore and coal and stone, all the way through the blast furnaces, the open hearths, and the finishing mills, but hardly any of them is in a position to furnish itself in any way whatever with the supplies of scrap that is required for satisfactory operation under present furnace practices, even though

the supplies of scrap now run to as much as 15 per cent of the total amount of metal out of which steel is made.

I want to say - little more about scrap in that connection, largely because of the public discussion that has centered around scrap in the last twelve or fifteen months, and the still unanswered question as to whether scrap is such a strategically important material for the steel industry that the Government should exercise some control over the distribution of it in world trade. There are two varieties of scrap that commonly are recognized in the steel industry--first, the so-called "home" scrap, which is made in the process of finishing steel products. In other words, "home" scrap is the croppings and shearings as the process of manufacturing goes on--the discards, the imperfect heats, and the like. Second, there is the so-called "purchased" scrap, which comes from outside the steel mills. Now the purchased scrap is of a great variety of sorts. Railroad scrap is the most prized, because of the nature of the material which the railroads use. Then there is industrial scrap, which is favored according to the kind of industry which is producing it. The thin shearings and clippings from the materials going into an automobile are not as desirable as turnings and borings from another industrial plant, but, generally speaking, industrial scrap is desirable because of the known character of the material that is in it, and to know the character of scrap is increasingly important. Finally, there is "country" scrap that may be anything, depending on how resourceful the so-called "junkies" are in prying things loose.

The question of supplies of scrap have been much discussed politically and economically in recent months, but I think if you are interested in the debatable question as to the merits of the case as to whether there should be a licensing as to parts of scrap, in order to conserve supplies for domestic production, you had better read a recent Bureau of Mines report on secondary metals, which secondary metals are not unimportant factors in the whole group of metal industries. That report has, to my way of thinking, perhaps, the clearest objective approach to the question of scrap supplies and the control of the movement of scrap that has been prepared so far.

One more point in regard to this question of scrap. I referred a few minutes ago to the increasing complexity of steel because of the variety of materials going into it. If a variety of materials go into steel in the manufacture, a variety of elements will be in steel after it has been used, so that when it finds its way into a scrap pile there may be, if it is scrap collected from heterogeneous sources, almost anything in that scrap. Manifestly, if one wants to know what is coming out of a

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steel furnace when the steel is poured, one must know what was put into the steel furnace when the melt was in the process of making, so that the problem of sorting, the problem of analyzing the quality and composition and character of scrap is a new feature of the steel industry that is presenting a good deal of difficulty from various directions.

When you consider the question of suggested control of exports of scrap, because of the volume of movement of scrap out of this country in recent years, you may wonder two things, perhaps. You may wonder, first, why so much scrap has been going out--something like four million tons last year. Well, there is one very good reason for that. When scrap is used, and it is possible to make steel with a hundred per cent scrap and no pig iron whatever, the steel maker avoids entirely the investment and the operation and the problems that are inherent in the coke oven-blast furnace combination which must stand back of a steel furnace if the steel is to be made out of pig iron entirely or in part. Dealing with countries like Italy and Japan and some of the other foreign countries which are not as well off in coal or coking coal as they might be and which would like to have steel industries with a minimum of investment and a maximum of output permissible, the use of scrap in large proportion, even to preponderance, is a happy solution of their question. Second, you may wonder that, really, does four million tons of export scrap mean in proportion to the potential supplies of scrap in the United States. I don't know the answer to that, but it is probably true that there are in the United States at the present time not far short of a billion tons of iron and steel in actual use, most of that is potential scrap, not immediately prospective scrap this year because some of it only went into use this year and last year, but there is always a part that is becoming a candidate for use as scrap, and increasingly so as time goes on, so that whenever you think of the problem of scrap from the standpoint of either the steel industry or the strategic and military importance of the steel industry, don't forget that at a price, very large quantities of scrap can be called out from all the uses in which steel is now put in the United States. I suppose that in theory, over a period of forty or fifty years the bulk of that billion tons of steel ought to return and be remelted, although theory may not prove to apply in that case.

Now for our third topic--the question of steel production and its finished products. You will note again on page two of those tables that I gave you in the first table a variety of figures. They are relative to capacities and I want to say a word or two about the question of capacities for two reasons. In the first place, there is a good deal of discussion among commentators and critics of the steel industry about excess

capacity in the steel industry, or surplus capacity in the steel industry. I don't know what they mean. Manifestly, if the industry is not using all of its capacity at any given moment, for that moment the capacity that is not being used may be surplus or excess capacity, but if at some other moment all of that capacity is being used, then at that time there isn't any excess or surplus capacity. Suppose those two respective times come within a space of twelve months of each other, what is your answer as to excess or surplus capacity in the industry? Those two situations have existed within the space of twelve months in the years 1937 and 1938 because in May or June of 1937, practically the entire capacity of the steel industry was at work and people who wanted to buy steel were not able to get it as promptly as they would like to have it. A year later about that per cent of all the capacity of the steel industry was at work and the other eighty per cent was doing nothing. Now was that eighty per cent surplus or excess or not? It seems to me that you have to consider the peak load in all probability, rather than the minimum load to arrive at your answer.

In the second place, there is a great deal of discussion about the efficiency of capacity in the industry, whether it is modern and economical, or whether it is antiquated and uneconomical. There are two parts to the answer of that question. It has to be answered in one way in respect to the basic facilities for making steel, say in the open hearth furnaces, and it has to be answered in another way in respect to finishing facilities, that is, taking the steel from the ingot or raw form in which it is poured and making it into the variety of products in which industry can use them. Take the finishing mills first.

It is true probably that during the last seven or eight years somewhere around seven or eight hundred million dollars have been spent by the industry on finishing facilities, on raw finishing mills, improved finishing mills, or the addition of collateral equipment to go along with the finishing mills to give desired qualities to the products that they are making. That figure of seven or eight hundred million dollars spent over the last six or eight years represents a large fraction of the whole plant and property account of the steel industry. So large a fraction of that whole figure that it, probably, in itself may be taken as conclusive proof of the fact that by and large the finishing facilities in the steel industry are as modern, are as efficient, and, therefore, as economical, cost-wise, and output-wise as it is reasonable to ask to have.

Turning now to the steel furnaces, the basic process in the industry, the open hearth furnace, there undoubtedly are a good many, numerically, not so many from fraction of total steel-

making capacity, of those furnaces which are not new, not of the latest design, not of the most efficient size for the lowest cost production. Now, how many there are of them, and what fraction of the total they represent, I don't know, but it probably is true that until the industry gets to an operating rate in excess of seventy-five or eighty per cent of total capacity, the industry is not under the necessity of using very much in the way of inefficient or uneconomical or higher-cost steel-making furnaces. In other words, those older, less modern in design, less economical in size, or however you want to explain their shortcomings of character, may make up as much as the top twenty per cent of the total steel-making capacity, but it is rarely that the industry finds it necessary to go into that top twenty per cent for any sustained interval of time. To operate much above eighty per cent of capacity probably occurs maybe as much as ten or twelve months out of ten years, so that the characteristic condition in the steel industry on the usual rates of operation would mean that the units being employed for the production of steel are efficient and economical.

I have labored that point a little bit, perhaps more than it deserves, but because of the frequency with which you will run into the comments as to surplus and inefficient capacity in the industry.

From the furnaces through the finishing mills, steel goes into a great variety of forms. It is sometimes said that there are a hundred thousand different varieties of steel if one takes shape, size, analysis of chemical composition, and all the varieties of combinations in which they may be put together. It doesn't make very much difference whether there are a hundred thousand or twenty thousand, the conclusion is the same and that is that from a comparatively simple industry forty years ago when steel was more or less of a mill-run type, "made by the mile and sold by the piece" as commonly said, it has come to be an industry of a limitless variety of combinations of requirements, originating with thousands of consumers, each of whom has his own individual desires to be satisfied, as a result of which, the problem of making steel today is a problem in close chemical analytical control. To that now are being added various physical controls as well. I would like to illustrate those two points for you by simple examples.

Ordinary steel is a combination of iron and carbon. Its qualities vary with the percentage of carbon combined with the iron. Now, the carbon range, as the steel producer or the steel buyer calls it, can be controlled within very narrow limits, as, for instance, from a quarter of one per cent to four-tenths of one per cent of carbon. Now, mind you, that means in a ton

of steel a matter of about five to nine pounds of carbon, uniformly distributed through twenty-two hundred and forty pounds, a degree of closeness of analytical control which is almost unbelievably exact.

That is one illustration. The other one is the so-called control of grain size, a physical characteristic of steel. The steel producer today is prepared somewhat reluctantly it is true, but, nevertheless, if you insist on it, to give you a steel in which the grain size will fall all within certain specified limits. When you look at ordinary steel, it appears more or less amorphous. But, under a microscope you will find that it is made up of grains of different appearances. When controlled grain size is specified, the producer undertakes to furnish a steel in which the individual grains within a cross section will fall within certain limits of size. Whether it is worth the trial and the expense is still a debated question in the industry, but when consumers insist on it they get it.

That trend toward specification steel in composition, close in analysis and in physical qualities, is perhaps the most significant of all recent and present trends in the industry, and it creates, probably, the greatest number of problems with which the industry has to struggle, problems of exactness in manufacture, problems of cost of production, problems of testing to determine that the processes are giving the desired result, and problems of keeping the customer satisfied that he is getting what he said he had to have. I think, if you will talk with some of the people in the military establishments of our Government, you will find that they can tell you perhaps more than almost anybody else can about how easy it is to write a close specification and what a hell of a time the producer has to meet it.

There is one final phase of that question of specification steel that I want to mention, not because I have the answer to it, but because it is very interesting in opening up a new line of consideration. You will notice, if you look at the figures on page three of the little folder that I gave you relative to production of alloy steels, that the tonnage for 1937 is not up to the tonnage of 1929. As a matter of fact, you will find that the alloy steel figure for 1937 represents only about eighty per cent of the output of alloy steel in 1929, whereas the total production of steel in 1937 was about ninety per cent as large as it was in 1929. Now, two things appear to have been happening. For one thing, there have been more kinds of alloy steels made and the uses of alloy steels have been widened, and yet the total production of alloy steels has not fully kept pace during that time with the total production of all kinds of steel. The other thing that has been happening is that straight carbon steels have

been made to do more acrobatics than they used to be able to perform. Carbon steel used to be run-of-mine material that was good for all ordinary commercial purposes, but wasn't able to do very much ground and lofty tumbling in the field of industrial applications. But some of the large body of metallurgical engineers and research workers in the steel industry today are disposed to take the position that if carbon steels are put through the right kind of treatment, either in the process of melting or in subsequent heat treatment, or the like, one can do with carbon steels many of the things that heretofore have been possible only after the addition of important and expensive alloys. Whether there are enough facts yet to prove that claim I am not in a position to tell you, but, at least, something that you ought to have in mind as one of the very latest of all the trends in the steel industry is the flexibility of use of plain carbon steels of different analyses of carbon content that is being accomplished by proper physical and heat treatment of those steels in the course of manufacture.

Now the question of labor and employment. There are two points there that I want to mention very briefly. One is the question of the supplies of labor in the steel industry and the other is the question of the cost of labor in the steel industry. You probably have heard a good deal about so-called technological unemployment in industry. If there is any industry at all among our basic industries which has gone a long way in technological improvement, it is the steel industry. It is more highly mechanized today than it ever has been before, but at the same time the number of employees in the steel industry is greater than it ever was before and the increase of the number of employees in the steel industry in recent years has been greater than would be required to offset the reduction in the length of the work week and work day. The answer, therefore, is conclusive that mechanization in the steel industry has not displaced any part of the aggregate number of workers in the industry. It may have displaced John Jones as a worker from the job in which he was previously employed because that job no longer exists, but it has not permanently displaced any number of John Jones' from the industry. Moreover, in 1937, when the industry was operating at more than ninety per cent of capacity, there were many places in the industry where they were beginning to feel the lack of skilled workers who had had experience in the steel mills.

Now the question of costs of labor in the steel industry. Wages are higher than they ever have been before and wages are more inflexible than they ever have been before. There is a degree of rigidity in cost of labor which is unlike anything previously known in the steel industry. It creates a very serious problem with reference to the successful and profitable operation

of the industry. Whether the trend of wages will continue to be upward no one can say at the moment, but there is a real problem for the industry in that question of high wages and seemingly very considerable rigidity in wage levels.

Now the question of demands for steel and the prices for steel. Demand for steel determines the rate at which the industry operates. There is no such thing as operating in the steel industry without orders in hand, because the variety of steels to be made both in composition and in form is so limitless that the average steel producer has no idea whatsoever of what kind of steel to make, take it generally, until he has the express desire of his customers clearly set forth to him. Therefore, when demand falls, operations fall and the problem of smoothing out the curve of steel production, about which some people are fond of talking, really is basically a problem of smoothing out the curve of fluctuating him in the minds of a hundred and thirty million people.

In connection with the operating rate, there is one interesting problem now--where does the producer break even? I was talking about that with one of our newspaper friends some time ago, who asked me if I could tell him what the break-even point was in the industry. I answered, "No, I don't think I can. I'd like to know," and I added, "I don't believe there is any operating man in the steel industry today who can give you an unqualified answer to that question." He said, "You're wrong. I got an unqualified answer the other day." I said, "What was it?" "Well," he said, "I asked one of the prominent operators of the industry, whom you know, if he could tell me what the break-even point was and I got an unqualified answer." I said, "Yes, you've told me that, but what was the answer?" He said, "The answer was 'I don't know whether the break-even point is 40, 50, or 60 per cent.'" Truly unqualified. Now the break-even point varies, of course, with demand. It varies with the composition of demand. You might have an operating rate of fifty per cent made up of certain classes of products and lose money, and you might have an operating rate also of fifty per cent made up of a different distribution of products and make some money. So there isn't any flat or unqualified answer to that question, but it probably is true that under existing conditions of not very heavy demand and conspicuously poor prices and rigid costs, the steel industry as a whole can't break even at fifty per cent of capacity operations, and, over a period of years, taking good with the bad, the average operating rate of the steel industry will not exceed sixty-five per cent. The actual rate will be higher than that at times and lower at others, but when you put them all into an average, it will run not above

sixty-five per cent over a period of years so that if they can't break even at fifty per cent, there is only that small part of the time when producers can bring their average up to the levels approaching sixty-five, when they can make money. That is probably the biggest single problem in the industry today, because, unless an industry can be operated profitably, it can't be a successful industry that perpetuates itself.

You men, and the establishment that you represent, are vitally concerned with a progressive, successful, efficient industry, and it can't be done on the basis of business where the producers don't get a new dollar back for an old one, and that is where they find themselves today. There is much talk about the steel industry being pigheaded, obstinate, reactionary, and all the rest of the adjectives that are synonymous and collateral to those, about its price policy, as if there was something reprehensible or almost immoral about trying to get a price for a product that will let the maker break even. It seems to me that there are two questions which any intelligent man can ask himself in connection with the price policy of any manufacturing industry and those two questions are simple ones. The first is, "Has the price of the product limited its use?" and the second one is, "Has the price of the product restricted the growth of other industries which use those products?" Now ask yourselves those questions with reference to steel and if you can answer them, as I phrased the questions, in any other way than "No", you have a better imagination than I have.

Let me tell you this. The price of steel is the lowest price for any metallic product that the world knows and steel is the most useful, most adaptable, most flexible metallic product that has ever been discovered. You pay five cents now for zinc, you pay five and a fraction for lead, you pay eleven and a fraction for copper, you pay twenty cents for aluminum, and so on, and you can't make the lot of them combined do what you can make steel alone do. And yet the fact that steel sells for two to three cents a pound is regarded in some places as something that ought to be punishable.

You are not economists. If you were you wouldn't be here, and, therefore, I can say this. Among the so-called classical economists, classical because they are badly out of date, there is a theory--a very popular and favorite theory--to the effect that price determines demand, and so they express it in these terms: that for any product there is elasticity of demand with fluctuating price. That probably is true to a degree in regard to cigarettes and beer and a lot of other things, but I defy anybody to present any convincing evidence to the effect that there is any elasticity of demand with fluctuating price for an item like steel. Now, if you turn around and say to me,

"Can you present statistics to show that you are right?" I should say, "My time is getting close to the end and I will have to go on to the next topic."

Now, if you will look at the top table on the first page of the folder that I gave you, you will see certain financial figures. I merely want to make a couple of points in regard to those figures. Note the figure showing huge capital investment. That indicates one of the outstanding trends and one of the outstanding problems. You can't establish or operate a steel industry without a huge investment of money. It probably is true that, if any one of you wanted to start out and establish a new unit to produce steel, from the open hearths through the finishing mills, (leaving out, now, the coke ovens and the blast furnaces which should stand behind your open hearth furnace) in order to have finishing mills to permit you to make any range of products, the initial investment would run in excess of one hundred million dollars and you still would be a comparatively small factor in production. Huge capital requirements present a double aspect, for the trend is toward still larger capital requirements and the problem is to find any way that you can justify the furnishing of the capital to the people from whom you have to get it. There is also the low turnover as indicated by the sales figure, (that is an estimated figure, but I think it is not far from reality) with a value of products sold, two and a half billion dollars in 1937, which was a big year. There have been only two years bigger, and yet at that rate it would take approximately 100 years for the industry to turn its capital once. Let me illustrate that for you into somewhat simpler terms. Taking a dozen companies in 1937 which were important enough to be representative of the entire industry, on the products which they made for sale the average profit was a quarter of a cent a pound. The corner grocer makes more than that on sugar.

That is the biggest problem and the most discouraging trend of all in the steel industry, because, unless you can have a profitable industry you have an unprogressive industry, and an unprogressive industry cannot be an efficient industry. With an unprogressive and an inefficient steel industry in the United States, one of the principal arms on which the military establishment must base all its plans and all its performance is not going to be adequate when needed.

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Discussion following lecture of Dr. Walter S. Tower  
October 17, 1938

Q. Dr. Tower, I would like to know a little more about this scrap material. How do the foreign countries, Japan, for example, know what quality of steel they are going to get from this scrap?

A. They don't. Let me put it in a slightly different way from that flat-footed answer. They will buy almost any kind of scrap and then by sorting, and especially sorting with reference to analysis, they have a pretty good idea of what they are putting into the open hearth furnace. With the adequacy of very low-price labor in Japan, the problem of sorting is a very different one for them than for us. Under the circumstances, therefore, a good deal of the scrap that goes to a country like Japan would be distinctly second choice for our own steel producers or would not even be acceptable to some of them.

I would like to add to that in order to make it perfectly clear. By a knowledge of what your scrap contains you can get perfectly satisfactory steel out of the use of a hundred percent of scrap. As a matter of fact, one of the prominent suppliers of steel to the Navy very commonly makes all of its steel from hundred percent scrap. And when you meet Navy specifications you aren't travelling a road that is too smooth.

Q. Dr. Tower, you say the price of scrap copper, for instance, is about a cent a pound less than the market price. What would be the price of scrap steel compared with steel?

A. The better thing to compare scrap steel with would be pig iron because the price for steel is a price for a new product that is available for industrial use and is not in the condition in which you would think of it as a material for the open hearth furnace. Pig iron, however, is a material for the open hearth furnace, and your comparison would be as between scrap and pig iron. Very seldom does the price of scrap vary from the price of pig iron by more than a couple of dollars a ton, sometimes as much as two below and sometimes as much as two or three above, but the two move relatively close together, with scrap cheaper than pig iron generally.

Q. When the price of steel runs only two or three cents a pound and the mills are unable to make a profit, what should that price be in order for the mills to make a normal profit?

A. It is pretty hard work to say. There are so many different factors that enter into it. A price that would be adequate at 90% of the operating rate wouldn't help you at all at 20%, so that in theory if your price always were going to show you a profit, irrespective of your rate of operations, the price ought to go down when operating rate goes up and ought to go up when your operating rate goes down. Unfortunately, of course, our friends the classical economists would have both feet in the water because according to their theory when demand increases, prices increase, and when demand slackens price likewise slackens so that they are in trouble one way or the other when it comes to steel prices. I suppose it is probably true that with present day costs as rigid as they are, if they were to remain unchanged the price of steel would have to go up, for an operating rate of 55%, which is a

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little better than present operating rate, the price of steel would have to go up at least \$5.00 a ton, maybe even more. Now, it is very easy to take \$5.00 off because it requires only a stroke of the pen or a whispered conversation with a preferred purchasing agent, but to get \$5.00 on is a different job.

Q. Dr. Tower, I wonder if you would be good enough to say a few sentences on the effect of the N.R.A. on trade practices?

A. Do you mean temporary or lasting?

Q. I would like to hear from both sides, but I will be glad to get either one.

A. It is really two questions. I would say that from the standpoint of temporary effects for those industries that came under well thought out codes under the N.I.R.A., there was a very distinct improvement in the level of trade practices in the industries affected. I don't think there is any doubt about that. But we have lived three and a half troublesome years since then; there were only about twenty-two months of exposure to the effects of what we might describe as "desirable reform", and it doesn't take anything like three years to get over the effects of twenty-two months of exposure. I don't know the facts in regard to all industry nor do I know all the facts in regard to even our own industry, probably fortunately for my peace of mind, but I think the chances are that everything that was learned in those twenty-two months has been forgotten and some of the things that they heard about while they were in the house of correction they have now begun to practice themselves, not having known them before. Did you ever know a boy who went to a reform school?

Q. Dr. Tower, in your opinion what will be the effect of the drastic price change that has been recently put into effect by the Carnegie Steel Company?

A. You would have to leave out the name of any particular steel company because I couldn't agree with you that any individual company was responsible. That is one of the interesting phenomena of the steel industry, that nobody ever cuts a price. It is always a case of meeting a price which has been cut. I would say this in regard to the present price situation in the steel industry. It is probably worse from the standpoint of profitable operations, probably worse from the standpoint of what might be described as sane, administrative direction of industrial affairs, than has been the case at any previous time about which I have any knowledge.

There are always wormholes in the price structure of any industry except a few that are so closely controlled by individual concerns that there isn't any chance for the worms to get in, but the steel industry has never been devoid of wormholes. The present price structure is a composite of wormholes, the connecting tissue almost having vanished.

Commander Dunham: Would you care to say anything about labor relations as a correlator to labor costs?

A. There is dynamite in that question. I don't know quite what you have in mind. There are, of course, these facts to be pointed to. There are certain members of the steel industry which have formal signed contracts with national labor organizations. I think there are some fifty-five steel companies of different sizes that have such signed

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contracts with the national labor organizations. There have always been in the steel industry craft unit labor organizations, like the electricians, carpenters, etc., and then there are the other groups of steel companies numerically the largest, and I think with the actual number of employees representing a preponderance of a total of the employees in the industry that handle their labor relations through so-called employee representation plans. In both cases negotiations go on between management and labor; in other words, there is collective bargaining in the sense that employees express their opinions, management expresses its opinions, and an attempt is made to reach a satisfactory adjustment as between conflicting opinions. Where the merit lies in respect to one system of procedure as against the other, I think we are too close to the facts at the moment to be able to draw the really considered opinion, but I think the majority opinion in the industry is that in the long run they will be able to run a more successful industry, both from the standpoint of the internal affairs of the industry and the external relations of the industry, to consumers and users of the product if they don't have domination that may be injected in their labor relations by a national labor organization.

I don't know whether that answers your question or not, but I have tried to give you the facts. My opinion is no good.

Q. Dr. Tower, could you tell us to what extent non-ferrous metals are encroaching on your market for the alloy steel?

A. I have a good deal of personal doubt -- and this is more opinion than fact, if you will forgive me for answering in one case by giving facts and in another by expressing an opinion -- as to whether one can fairly say that there is any serious or lasting displacement of steel in its various forms and application by the non-ferrous metals. Now there is competition from copper and brass in tubular products in some sheet forms; there is very definite competition between brass pipe or copper tubing in certain applications in domestic house construction. You may even find the curious phenomenon of a pipe salesman in a steel industry building a house to live in and putting brass pipes in all of his plumbing. That actually happened. There is competition from aluminum in various forms. Qualitatively there is competition; quantitatively I doubt if it needs to be given very serious consideration. If you consider the total tonnage, for instance, of copper and aluminum which makes its appearance in the course of a year as new metal, it looks wholly unimportant beside the tonnage of steel which had been made in a corresponding year. When you think of the steel industry think in terms of an industry that is equipped to produce about 1,350,000 tons of steel a week. That's a lot of material. That is about three or four years' output of aluminum tonnage weigh. It is more than a whole year's output of copper, and yet it is a week's production for the steel industry. Quantitatively you have in steel a material, a metallic material, that hasn't any matching parallel in the whole metal kingdom, which is another fact to go along beside the cheapness, the flexibility, the adaptability of it in use.

To come back to a perfectly specific answer to your question, that

competition is around the fringes. There doesn't seem to be any possibility whatsoever for it to make any depth of penetration into the mass of uses where steel is applied. Also, there is a whole family of so-called low alloy high tensile steels blossoming into existence which are weight-saving in terms of the strength required as compared with the older forms of steel, and I dare say that there is a partial, if not a complete, answer to the tendency of some of the lighter of the non-ferrous metals to begin to encroach on the margin of application into places where inertia or the momentum of motion were important factors to consider in the particular use where the material was being put. If the steel industry had nothing more serious than that to worry about it would have no trouble from insomnia.

Q. Dr. Fower, approximately how long does it take to expand from 40% production to 80% production?

A. About as long as it takes the buyers to decide that things aren't any longer going to the bow-wows and good days are here again. A less facetious reply perhaps is merited by that question. That is one hundred percent increase, from 40 to 80. Depending upon the kind of demand that was involved it might vary from three months as a minimum to six months as a maximum. If you have in the back of your mind, for example, the possibility of emergency requirement arising for military use when the industry was in response to commercial demand, operating at 40% and your military program would call for such needs as would represent an 80% operating rate, I would hazard a guess that the industry could put itself

on an 80% rate in at least three months, if not better under the urge of the emergency.

Colonel Miles: We don't want to keep Dr. Tower too long and we have a number of distinguished guests here this morning, largely from a department which is very much interested in steel, and we would like to give an opportunity to some of them to say a few words if they would care to.

General Wesson?

General Wesson: I would like to ask the Doctor a question if I may. I understood him to say that notwithstanding the great technological improvements that had occurred in the steel industry, there has not been a decrease in the total number employed. I note from this production table that the amount of steel produced in the last two years, for example, is not materially different from that produced in the 1920's. Since that time I assume that there have been a great many technological improvements, and I wonder where the men and how the men have been absorbed in the industry who have been displaced in certain phases of the industry as a result of mechanical improvements?

A. They have been absorbed, or at least a like number has been required. We don't know the facts as to the fate of John Doe and John Smith, and so on, all along the line. Let me elaborate that in respect to one particular aspect of technological advance. One of the most conspicuous of all in the technological advances has been in the processes of rolling sheets. From largely a hand operation up to a dozen years ago, it has now become almost entirely a mechanized operation in huge continuous mills which take an ingot or a bloom, which is only a slightly formed

roll stage beyond the ingot, at one end and without stopping turn it out at the other end into a finished sheet form, and as it emerges at the far end it may be travelling fifteen hundred feet a minute or eighteen hundred feet a minute, a huge strip. Now you look at one of those mills and it seems to be working automatically, there doesn't seem to be anybody required to keep it going. It has been alleged that as many as 80,000 men have been displaced from the industry because of the introduction of the so-called continuous strip sheet mill to which I refer. Now we have been investigating that question. We haven't yet finished our collection of information, but we have taken representative companies that are in the sheet producing phase of the business and asked them to give us their facts as to how many they employed when they had the old-fashioned hand type of sheet mill production and how many they have employed in sheet production today, limiting it to sheets, not spreading beyond into other parts of the company operation, whatever it might be. We have found that the number of employees has increased rather than decreased, that the collateral needs for employment have added to the number of men that they require rather than having diminished the number of men that were so employed. True, the total tonnage of sheets has increased very considerably so that the output is up in proportion, but actually that phase of technological advance, the most conspicuous that has occurred within any short interval of time, has not diminished the number of employees in that branch of the industry.

General Wesson: One other thing -- I wish the Doctor could give this talk before the House of Representatives.

(Off the record)

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nearly generous enough to my very good friend Major Minton who ought to stand up and let all the men in this room see a man who came into a job surrounded by limitless complexities and difficulties in trying to match Army requirements for a first class campaign against the multiplicity of facts and data and information that we had already collected in our records relative to the character and distribution of the producing capacities which might be called upon in case of emergency to meet those requirements. Now that's no child's task. It is a job that any man might well be excused in ducking if he could see the job coming his way and get started before it reached him. Major Minton did it most extraordinarily well, and I hope that every time I come down here somebody will give me an excuse, as General Harris has just now given me the excuse that I was looking for, to say a word about Major Minton and the job that he did.

Major Minton: Dr. Tower minimizes the importance of the help he gave us in preparing that plan. Of course the plan is a joint effort. All of the supply branches of the Navy supplied their requirements and that was the biggest job. I would like to ask Dr. Tower a question, if he would hazard a guess as to the effect on certain of the producing centers of the recent change in the basic point of the system, like Pittsburgh, for instance, what will be the long distance effect on the steel industry centered around Pittsburgh to the basic points?

Dr. Tower: I take back half of what I said about Major Minton. I thought I was going to get out of here without anybody asking me that question. Really, the only honest answer that I have is that I don't know, and it will take sometime to find out. However, on the other hand,

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it is sometimes easiest to talk about things concerning which we have no knowledge because then we can talk entirely without prejudice. The changes in the price which took place at the end of June were of two sorts. There was a straight cut of several dollars per ton in practically all of the various classes of products and then at the same time there was an abandonment of the so-called basing point differentials which had existed for a dozen or fourteen years. Those basing point differentials were of this sort. Ordinary carbon bars at Pittsburgh, we will say, were two cents per pound or two dollars per hundred pounds, and the same class of carbon bars were quoted at Chicago, another place for basing prices, at \$2.10 or \$2.05 per hundred. At Birmingham, another basing point for quoting prices, it was \$2.15. In other words, there was a dollar or two dollars spread in favor of Pittsburgh or against Chicago, as you might put it, and three dollars in the case of Birmingham. Those were eliminated and the prices for those products became the same at all those basing points. Some commentators immediately jumped to the conclusion that the practice of quoting basing point prices in the steel industry had been abandoned. Nothing of the sort had occurred. The practice of quoting basing point prices is just as unmodified as it ever was except that there is a different relationship today as between the prices at their respective basing point from what there once was. Now, changing that relationship between the prices at the respective basing points has undoubtedly a very, very far-reaching ultimate effect on the competitive position, the competitive ability and the competitive success of different producers differently located in respect to market. I have a good deal

of doubt as to whether the respective competitors yet know fully what has happened to them, and it will take some years, I believe, Major Minton, for that problem fully to work itself out. Specifically, take a mill which has a mill and only one mill located at Pittsburgh. Now, if it wishes to sell its product in Chicago or west instead of having a dollar or two dollars to help it get there a dollar or two dollars as represented by the former higher price that Chicago as a basing point now has to face the fact that the Chicago point is precisely the Pittsburgh price with which it starts, and therefore if it wants to sell its products in that more remote market all the privilege of doing so is paid for out of its own pocket. Expressed in another way, it becomes less easy for the Pittsburgh mill to compete at a profit in the market that is closer to the Chicago mill. Now, that is only one separate and isolated illustration out of a multitude that you could draw. As a matter of fact, there is hardly a single consuming point in the whole country, except the very few located immediately around Pittsburgh, where there has not been some fundamental alteration of the relative position of different sources of supply in respect to putting products into that individual market, and everybody in the industry, you might say, is at the present moment, therefore, in the process of finding out how much it is going to cost them to continue to do business in the places where they previously found their orders and shipped their tonnage, and until they have had a chance so to adjust themselves you might almost say that they are operating in a daze or at least they are operating in a fog if they are in possession of their senses because they really don't know the answer. A very disturbing

factor it is, with reference to the problems that any individual management has to face.

Colonel Miles: We have another steel expert here this morning; Major Ritchie, would you care to say a word?

Major Ritchie: I have enjoyed the discussion very much.

Colonel Miles: Would any of our other guests like to say a word or broach a question? If not, I think we will say to Dr. Tower that we appreciated more than we can express to him the value to us of his talk. Also, I want to thank General Weason and General Harris for their remarks.